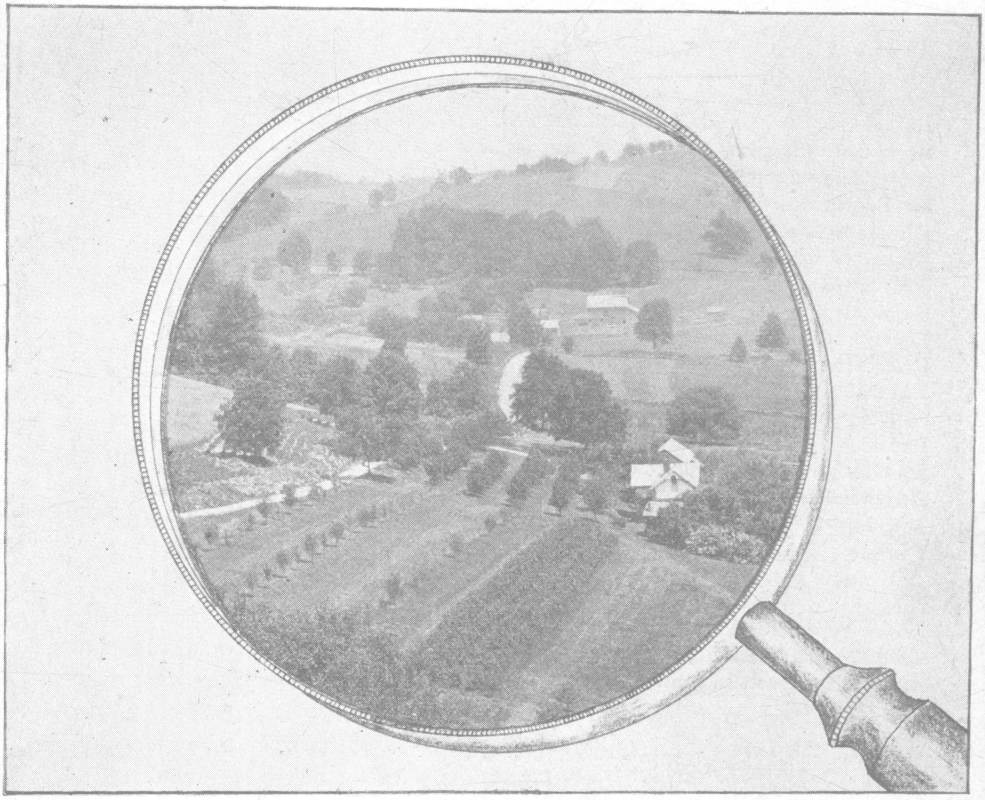
OHIO AGRICULTURAL EXPERIMENT STATION

Report of the Division of Horticultural Inspection



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Ohio Agricultural Experiment Station.

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REPORT OF HORTICULTURAL INSPECTION.

BY F. H. BALLOU.

PREFACE.

The Division of Inspection of the Horticultural Department of the Ohio Agricultural Experiment Station was created late in the spring of the year 1908, when the fund which, for two years previous, had been appropriated to the State Board of Agriculture, at Columbus, for the joint support of a Division of Horticulture in that institution and the Ohio State Horticultural Society was, very unexpectedly, to all concerned, transferred to the Horticultural Department of the Experiment Station. While the purpose of this transferred fund was not clearly defined by the Senate Finance Committee which was responsible for the change, it was quite naturally assumed by all who were familiar with the former arrangement that the fund was yet designed for the support, at least in part, of the Ohio Horticultural Society. In accordance with this supposition the Executive Committee of the Horticultural Society proceeded to elect its Secretary. The choice was fixed upon one who was already an attache of the Horticultural Department of the Station, in the capacity of Assistant Horticulturist, and who by special arrangement was devoting one-half of his time to work for the Station. However, the Assistant Auditor of State ruled that, as no reference to the State Horticultural Society had been made by the Senate Finance Committee in its transfer of the appropriation from the

State Board of Agriculture to the Experiment Station, no part of that fund could be legally used in support of the Society. In this dilemma the Station came to the rescue of the Society by privileging the Secretary elect, in addition to his regular line of duty as assistant horticulturist plus the added work as assistant in charge of the new Division of Horticultural Inspection, now requiring all his time, to perform the service involved in editing the Society's transactions and otherwise caring for its affairs; but this service was to be no part of his duty to the Station nor included in the service for which his salary was paid. It was, therefore, evident that the wording of the appropriation measure, which provided simply for Horticulture and Horticultural Inspection, should be followed by the Station in letter as well as in spirit—that inspection and study of horticultural conditions, possibilities and requirements, in different parts of Ohio, should be carried forward primarily for the purpose of analyzing such conditions, calling attention to such possibilities and endeavoring to devise ways and means to meet such requirements as might be discovered.

This new line of work, because of the lateness of the date at which the appropriation was made, and because of a general uncertainty of the real purpose for which the sum was set apart, was not regularly taken up until late in the summer of 1908. The specific lines taken up at this discouragingly late date were: Observations of the special adaptation of various sections of Ohio to the growing of certain products; the possibility of successfully growing these same products upon a scale sufficient for home consumption and local markets in the lesser horticultural areas widely distributed throughout the state; the methods employed in the leading horticultural sections and a study of how far these methods might be employed to advantage in the less important, small or isolated areas; the examination of new fruits and other horticultural products originating in various parts of the state, or of improved strains of standard varieties springing into existence through plant breeding, or accidental, plant variation, and the holding of one or more field meetings where the horticultural public might be brought within close, personal touch and observation of striking horticultural object lessons.

The results of the season of 1908, to date, obtained in part from travel and observation, though principally through communication by correspondence with Ohio citizens in every walk in life, suggest that, in the main, no mistake was made in affording means for at least a temporary study of the horticultural interests and needs of our people. In view of the great field for usefulness and helpfulness

which such investigation, together with former observations along the same lines, has opened and spread before us, we may only trust that the way may be still more widely opened and more clearly defined for meeting the demands which are insistent upon every hand. These demands, as we shall see, are unmistakable in their character and significance; their recognition is the real, the true and the most important result of the work of the Division of Horticultural Inspection, and they suggest immediate preparation for enlargement of scope which should, by all means, transpose the Division into one of *Horticultural Extension*. A further simple seeking for peculiar conditions and requirements, alone, in horticulture, could hardly be justified when these are clearly apparent upon every hand and when our every mail embraces inquiries and requests which should indicate and direct, in a great measure, our future course. This course should involve no greater outlay of money than a simple system or plan of inspection. It should include, in brief, the preparation of such clearly written and attractively illustrated, elementary publications as will fully and faithfully cover "the great interrogation point" with which those, to whom the first principles of horticulture are strange, so persistently approach the Horticultural Department of our Station.

Such a change in the character of the work of the new Division is most respectfully suggested and earnestly submitted for the consideration of those who shall be reponsible for the continuation and enlargement of the work.

It is earnestly hoped that all, into whose hands this report may chance to fall, may go with us in our brief observations of the wonderful, peculiar and varied characteristics of our great State; of the progress and achievements and ambitions of our representative and foremost horticulturists; of the remarkable horticultural awakening of the multitude which is pressing countryward, whose insistent appeal to institutions of horticultural and agricultural education, experiment and research, for help along elementary and practical lines, should by no means be ignored nor overlooked.

INTRODUCTORY.

Truly Ohio is a rare garden spot wherein widely varied conditions, degrees and conditions of soils, elevation and climate combine to produce the widest possible range of choice products of the north temperate zone. Were the inhabitants of the state limited to the food products grown within its borders, we should yet be a substantially and luxuriously fed people. Were the materials for the construction and adornment of our homes confined to the product of Ohio woodland, coppice and border, such homes might yet be surrounded by trees, plants, shrubs and flowers which would leave little to be desired from the flora of neighboring states or foreign lands.

Hundreds of square miles of cereals blanket our western Ohio plains and valleys; fruitful, well-kept peach orchards have taken possession of the peninsula of eastern Ottawa county and other choice locations in northern Ohio; model vineyards border Lake Erie and cover extensive areas of the islands adjacent to the Ohio shore; apple orchards of noted repute for fruit of exceedingly brilliant color and superb quality are clothing the rugged hills of southern Ohio; broad fields of celery and onions annually abound in the fertile, reclaimed marsh-lands of Hardin, Medina, Wayne and other counties; great areas of potatoes extend throughout the basins of the Cuyahoga, Huron, Mahoning, Muskingum, Miami, Maumee, Sandusky and Scioto rivers and their tributaries as well as over the clays, loams and silts of the uplands adjacent to the headwaters of the Rocky, Killbuck and Tuscarawas.

These great districts of especial adaptability to the production of certain crops constitute one of the features which lend to Ohio a measure of independence equalled, perhaps, by few other individual states and excelled by none. But this is not all—the best yet remains to be told; it is this: There is scarcely a farm or a home lot in the state, no matter how small, isolated, hilly or rough, but where there are certain favorable little nooks or slopes or elevations or protected, fertile depressions, where all of the horticultural products enumerated can be grown in generous supply and of the most excellent quality, for family use or for the many brisk and appreciative home markets which abound within reach of almost every section.

There are but few property owners, indeed, in Ohio, who do not possess some peculiar advantage contributing to home-making or the growing of certain products of the soil. The growers of garden

products for the city markets, as a rule, locate near their markets and usually where the ground is level. Their special advantage is the comparative ease and cheapness with which such land may be tilled and cultivated. The land-owner back in the hills is sometimes almost covetous of these conditions; yet when seasons of late frosts in spring or early frosts in autumn cut down the crops of the valley gardener, he who possesses the greater elevation, even though handling of the soil be much more difficult, discovers reasons for self-congratulation and realizes, after all, that He who is responsible for the topographical shaping of our land has builded better than we should have done; that He is not a respecter of persons and has granted to all special, peculiar opportunities and blessings.

As these lines are being written, on the 21st day of October, 1908, all tender plants in the vicinity of the writer's home and office, in the valley of the Licking river, with an elevation of near 800 feet above sea level, have been sear and brown for many days, as the result of early frosts. At a small fruit farm eight miles distant lying between, and upon protecting hills and at an elevation from 1000 to 1200 feet, the tomato vines are green and yet maturing some fruit that is fairly good for table use; the foliage of fruit trees is green, bright and fresh, and conditions and appearances in general are sufficient to warrant the thought "verily this is a different and a milder climate."

With the extension and multiplication of facilities for rapid transit to and from country districts, there has come a general exodus of professional and business men, with their families, from the city. Even as they drifted, in their early manhood, to the villages, towns and cities, lured by the apparent promise of greater opportunities therein, so are they now drifting back to Nature where country homes may be established and their hours of respite from business or professional cares may be spent amid surroundings congenial to the great and rapidly increasing host of nature lovers and nature students of our day. These hundreds of newly awakened home-makers—fathers and mothers, sons and daughters, all equally enthusiastic—are clamoring for simple instructions in the first or rudimental principles of horticulture, forestry, floriculture and home adornment. They are determined to succeed in their new gardening, fruit-growing or farming operations, yet they realize their lack of that practical knowledge and training which would insure success. It is with no humiliation that they seek information; it is with the same energy and determination which have characterized their business and professional methods that they

communicate with or visit our educational and investigational institutions. They eagerly ask for help and confidently expect it to be forthcoming. The advanced technical and scientific publications commonly in the majority and available in unstinted supply do not especially appeal to them; those phases may become subjects of interest later on. They are especially looking for short, crisp, beautifully and truly illustrated treatises which will enable them to prepare for, select, plant, protect, propagate, prune, train, spray and attain, in a reasonable degree of perfection, the fruits of their thought and labor. An insistent demand in a worthy cause remains not long unsatisfied. The time is near at hand when experiment stations and agricultural colleges in general shall fully recognize this want and will promptly come forward with that which shall meet it.

SECTIONAL UNIFORMITY IN ORCHARD PRACTICE.

PEACH CULTURE IN OTTAWA COUNTY.

It is quite safe to assume that the history of orchard practice, in the different extensive horticultural centers of our country, is essentially similar. The years required for the establishment and development of the industry witness methods of planting and care almost as many and varied as the number and characters of the orchardists who inaugurate these unlike methods. As the industry grows in years, the methods of those who succeed best attract the attention of wide-awake and observing neighbors who promptly adopt the favorably noted improvements, modifications or distinctly different plans or systems, as the case may be. It was stated to the writer, by a leading orchardist of northern Ohio, that the ultra-progressive fruit growers in his section observe their neighbors' operations with hawk-like concentration and are quick and sure to seize upon a plan or practice that is proving superior to their own; and that only the lazy and shiftless growers are lagging in the grooves worn by former generations.

This general adoption of the more excellent practices prevailing in a particular fruit growing section results, naturally, in a method which is, in a measure, peculiar to that section. A certain local standard is thus gradually evolved and established, which is thereafter difficult of further modification because of a prevailing disposition on the part of the growers to withhold recognition of

merit in any plan or scheme in practice which does not essentially conform to these well-fixed, sectional ideas. In illustration, we are familiar with the attitude of those who believe only in annual tillage and persistent, clean culture of orchards, toward the plan of planting and growing trees in sod land, with heavy mulching. We have experienced the futility of describing the Kniffen or "drooping system" of grape training to a company or audience of veteran vineyardists who have, for a quarter or half-century practiced the old, upright renewal or "fan-system" of training. I was told this season of a German gentlemen who is a staunch adherent to the "old school" of grape training, visiting the garden of a young neighbor who is taking much interest in the more modern systems of grape culture. The veteran critically eyed the long-stemmed vines stretching up to the point from which the bearing laterals should later droop. Reaching into his pocket he whipped out a formidable pruning knife and quickly cut off several of the vines only a short distance above the ground, with the remark: "dot vhas more like id." We are aware of the hesitation of those who have ever favored tall-bodied, high-branched orchard trees and the "pruning up" of orchards generally, to believe that there can possibly be saneness, to say nothing of safety and merit or common sense, in planting short-stemmed trees and severely and persistently "heading down" to facilitate all orchard operations. Yet we are aware that the various methods in different sections are bringing success to those who faithfully follow the plans of their choice.

In that part of the lake-shore peach belt embracing the great peninsula of eastern Ottawa county, north of Sandusky Bay, we have a good example of sectional uniformity in methods of orcharding. Of course there are slight variations, though these are just sufficient to leave the stamp of personality upon the plantations of various individual orchardists. Outside of parts of Catawba and other islands in proximity to the Ohio shore and the coast vineyards of Lake, Cuyahoga and other counties, it is doubtful if there can be found in Ohio another section where horticultural practice appears to be so nearly uniform.

It was the privilege of the writer, in August, 1908, in company with a number of central and southern Ohio fruit growers, to enter via the Lake Shore & Michigan Southern Railroad, the peach section in the vicinity of Gypsum and Port Clinton, on the peninsula. Here meet the eye, upon every hand, great areas of peach trees—the straight rows extending in some cases almost as far as the eye can reach. The trees, even of old orchards, are short-stemmed, broad-topped, low-down, sturdy, compact and the picture of health and

vigor. Apparently there is not a single foot of unnecessary leverage which can be exerted upon the branches by the burden of fruit, the danger of breaking and multilation being reduced to the minimum by this method of pruning, together with systematic thinning of fruits when the crop is heavy.

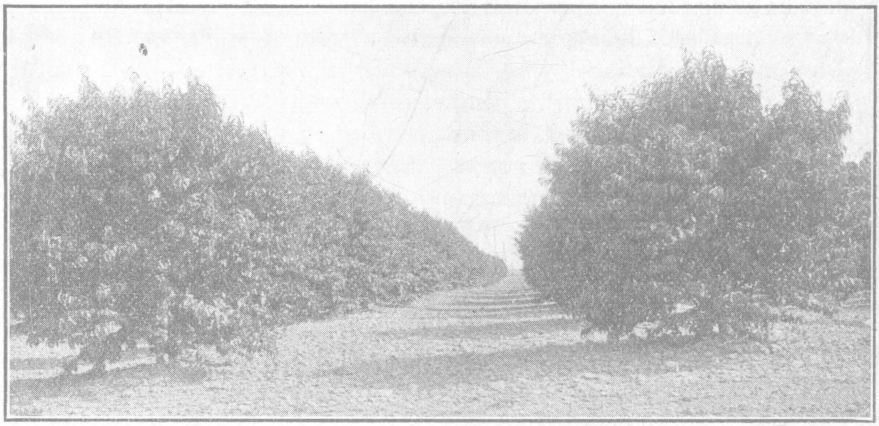


Fig. 2. Peach orchard near Gypsum, Ohio.

Short stemmed, broad topped, sturdy and compact.

It was a revelation to the fruit men of the more southern sections of the state. Remarks of surprise, wonder, admiration and commendation were heard upon every side; note-books appeared from pockets and pencils traced lines which recorded items of unusual novelty and interest to be dwelt upon at a later time in the quietness of their own homes. Here were great, cleanly cultivated orchards, whose trees might receive their annual pruning from a six foot step ladder; whose tops were subject to the peculiar covering power and merciless penetration of a downward directed spray from the elevation of an ordinary spray wagon; whose fruits might be readily, for the most part, gathered from the ground or from short step-ladders.

There is probably not another section in the state where the systematic pruning of orchards has been accorded such thought and attention, or reached so high a degree of perfection as in the peach belt of northern Ohio. The occasional apple orchards, too, are claiming their share of attention in this respect. This advanced progress in the science of pruning is due to a number of factors, possibly the most potent of which was the scourge of San Jose scale which infested this district a number of years ago. This enemy

obtained so strong a foothold before it was successfully combatted that cutting back the trees to mere "stubs" was rendered necessary, in order that every part should be fully covered by the lime-sulphur wash. In spite of this actual mutilation those orchards which were not yet devitalized by the scale promptly threw out healthy shoots which were annually and severely "headed-in" to preserve the much reduced altitude of the tree-tops. The practice of low heading and severe annual restriction therefore became a prevailing method, not alone because of the greater facility with which the trees could be treated, but because of a growing appreciation by the orchardists of a method embodying a definite system, extreme neatness and highly satisfactory results in the character of the product obtained thereby.

Fig. 3. Peach orchard east of Gypsum, Ohio.
An example of perfect cultivation
and close pruning.

Three additional factors render the northern Ohio peach belt superior to more southern locations: climate, topography and comparative freedom from the dread disease of "yellows." The warmth stored up in the vast body of water of Lake Erie, during the hotter months of late summer and early autumn, so modifies the temperature of the atmosphere that development and maturity of the wood growth and the fruit buds of the trees are seldom interfered with by premature freezing weather. The cold currents of air from the north which, in autumn, in more southern parts of our state, most

surely indicate the coming of frost, only bring, to the lake shore belt, on their undercurrents skimming the warm surface of the water, a temperature so modified as to eliminate grave danger of too early frost. Likewise, during the winter months, the great body of water becomes so icy that the temperature of the lake region is held at a low degree until late in spring, retarding premature expansion of fruit buds until danger of late freezing has passed.

The almost perfectly level surface of the land in central Ottawa county, and the northern part of the state generally, renders possible annual tillage of orchards. This cannot be done safely in the central and southern parts of the state where the land is hilly.

Annual plowing and clean cultivation, season after season, was the former plan of culture in the northern peach country; but the time arrived when, by this policy, the vegetable constituent of the soil reached so low an ebb that hundreds of acres of orchards suffered most severely. This, together with the effects of scale, leaf-curl and exhausted fertility, was responsible, in a great measure, for the death of whole orchard plantations during the severe winter of 1903-4. Growers of this section now recognize the importance of keeping up the supply of humus in the soil—either by the application of stable manure, where it is available, or by the annual growing and turning under of leguminous or other plants.

While some loss has been sustained through "yellows" the orchards of the north are singularly immune, as compared with the central and southern portions of Ohio, where this disease has reached the proportions of a dreaded scourge.

Now, what are the conclusions to be drawn from this chapter? These are those which, from equally close observation in other parts of the state, today confront us:

1 The great bulk of Ohio's home grown peaches must, under conditions similar to the present, be produced within the northern quarter of the state.

2 Lesser quantities will be continued to be grown in small, widely separated, especially favored spots in Ohio. In these isolated sections there is need of employing the better methods in vogue in the northern regions of the state, with certain modifications to suit local requirements.

3 There will hardly come a time when peaches will not be planted, at least in a small way, in connection with nearly every Ohio home, by lovers of this luscious fruit.

4 Inasmuch as a great number of our people will ever be interested in the growing of peaches, to a greater or less extent, it is incumbent upon those whose duty it is to extend worthy and helpful horticultural information, to disseminate such practical knowledge, in the form of literature, as shall bear clearly, forcibly and attractively upon the subject.

5 Among the elementary publications touching general orchard practice, none is in greater demand at the present than something dealing very briefly and clearly with pruning. Methods of culture must necessarily be modified to a considerable extent according to local physical characteristics of the section; but pruning and, I may well add, budding and grafting, are subjects of universal interest and application.

A STRIKING EXAMPLE OF ORCHARD RENEWAL.

There have been few bulletins issued in late years from the Horticultural Department of our Experiment Station, which have met with a kindlier reception or a wider demand, than "No. 180," which contained a brief, preliminary report upon a little experiment conducted in the Station's orchard, in renewal or rejuvenation of old apple trees. The writer alone has received some 400 letters inquiring about, requesting or commenting upon this bulletin. These letters came from every part of the United States—from Maine to California and from Wisconsin and Minnesota to northern Florida and Louisiana. These numerous letters afforded interesting data relating to actual conditions of old orchards in different parts of our country, but evidenced, as well, the awakening interest in these old and too long neglected institutions, many of which were established simultaneously with pioneer homes. Many of these letters came from persons who have, within recent years, come into possession of properties upon which these old orchards are situated. A considerable percentage of such transfers were made to buyers from cities, who evidently were seeking country homes. No doubt the old orchards may have played some part in the closing of many contracts—we do not know except in a few cases where statements to this effect were casually submitted; but it is clear that in every part of our country such orchards are, after all, farm and home problems of no little moment. Even under the most promising circumstances the renewal of old orchards is not all poetry and sentiment. Such work is attended by a deal of hard, wearing labor; and while results, where conditions are favorable, will repay well the expense of so doing, the old orchard should by no means be expected to take the place of a younger one, but to fruitfully and

profitably stand between the time of planting and the age of generous fruit bearing, of the newer generation.

At the time of taking up the subject of orchard renewal, at the Ohio Station, the writer, who was in immediate charge of that character of work, was not aware that operations of a similar nature were in progress in the state. This, however, was the case; and it was with real pleasure that it was discovered, during the summer of 1908, that an orchardist of Port Clinton, Ottawa county, had quietly inaugurated just such an experiment in 1901-2, as did the Station three years later. This pleasure, it is frankly confessed, is not so much because we find that the Station was anticipated three years in this work, by our Ottawa county friend, as because of the fact that his sentiments, his methods and his results, maturer than our own, are so closely in accord with those published in Bulletin No. 180, of this Station.

In July, 1908, a call was made at this fruit farm and the work which he has accomplished looked over with much interest and satisfaction. The observations herewith recorded as a result of such inspection certainly should be accepted as most excellent support of the statements contained and the instructions given in Bulletin 180.

The apple orchard was planted by the present owner in 1871. Before it came into bearing, however, he became engaged in business which required his presence elsewhere. For twenty-five years he remained away, finally returning in 1900. In the interim the orchard, which was growing upon excellent soil, had been pruned only to such an extent as to stimulate heavy, upright growths. From twenty foot ladders it was impossible to gather the fruit from some of the lateral branches. Spraying was especially difficult; and as San Jose scale was infesting his orchard, spraying in the most thorough manner became absolutely necessary.

The owner was also confident that, by lessening the height of the tops of his trees, he would reduce the number of "windfalls," secure increased size and better quality of fruit because of less bearing surface, and not least of all, improve the appearance of his orchard to a considerable degree.

The work of renewal was not done in a single season—the task was too great; but it was vigorously begun the spring following his return to the farm, and finished in 1902, so far as the heavy cutting was concerned. Many main branches extended well above the mean elevation to which he wished to reduce his trees, and some of these were from four to six inches in diameter at the point of cutting.

The new growths following the vigorous cutting were faithfully thinned and pruned back annually. In short, the work of heading back and the after treatment has been substantially the same as that recommended in Bulletin No. 180 to which the reader is referred for details.

The accompanying photograph shows a distant view of the renewed orchard with the owner in the foreground as a standard for comparison as to height. He has pointedly expressed his personal ttitude and that of his two loyal sons, toward renewal of old orchards, in this sentence: "While the boys and I take lower views of our apple trees, we take higher views of life. We do not recommend that apple trees be planted and allowed to "sow their wild oats" before taking them in hand. Better would they be led in the way they should go, then, when they are old, they will not depart from it."

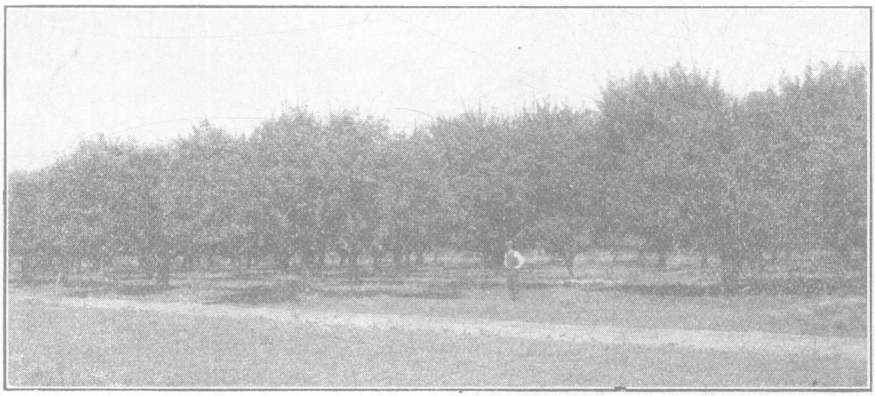


FIG. 4. An example of orchard renewal near Port Clinton, Ohio.

HORTICULTURE IN THE MAUMEE VALLEY.

The western limit of the great Lake Erie fruit belt, in Ohio, may be said to be that part of the state within the radius of 25 or 30 miles west and south of Toledo. This portion of the state is very level except in proximity to the larger streams, where the cutting down of the channels in past ages has caused slight erosion of the bordering land. The low knolls and slight slopes (called "hills" in that section) are most excellent sites for orchards—especially for the peach. The lake is not so far distant but that climatic conditions are measurably influenced by it, affording opportunity for wood growth to mature in autumn and retarding the opening of fruit buds in the spring. South and west of this not definitely defined limit the country merges gradually into the great agricultural section of western and northwestern Ohio, wherein fruit growing is engaged in only in small and widely separated areas.

The valley of the Maumee river, south from Toledo, is not only celebrated for the tragic events in the early history of Ohio—when the waters of the Maumee "ran bloody from battle," but is, in our day, noted for its fertility and the abundance and excellence of its agricultural and horticultural products.

A number of land owners of the valley make a specialty of fruit growing. Beginning with small fruits, the season is extended through the time of maturity of all classes of tree fruits and continued throughout the winter by means of spacious, private cold storage in which great quantities of winter apples are carried until such time as prices warrant placing them upon the market. "Marketing by trolley" is one of the novel features of this wonderfully productive valley. Whereas, in former days all produce had to be hauled from 20 to 30 miles by wagon, each load requiring a long days jaunt, the fruits are now loaded upon the electric express cars at a nearby village and, in from one to two hours time, are delivered, fresh and attractive, at the wholesale or retail establishments in Toledo.

One of the principal objects in visiting the Maumee valley fruit section was to observe methods of orchard pruning as compared with other sections in northern Ohio. It was found that here, aside from removing dead branches and thinning out those which crowd or interfere with each other, little cutting is done. Apparently large, broad-headed trees are desired—such as will carry the maximum quantity of fruit. Good size of individual specimens is obtained by systematic thinning of the fruit on the trees, rather than by restriction of tree growth. Peach trees are, of course, annually pruned back, though not to the extent that is done in the Ottawa county district.

A few orchards present valuable lessons in economic cultivation —in obtaining the greatest possible returns from the ground occupied by the trees while the young trees are growing. Bush fruits—principally currants—are planted between the rows and come into bearing in one or two seasons from the time of setting. These are permitted to fruit until the orchard comes into bearing and as long afterward as both crops do well. Potatoes are also grown between the rows of young trees. Potatoes and asparagus are largely grown. A plantation of ten acres of asparagus was noted growing on first bottom land bordering the Maumee river.

The success of those land owners first engaging in horticulture in the valley, early attracted the attention of certain neighboring farmers who also began planting orchards to some extent. The advent of the San Jose scale, however, frightened the majority of

these planters, who were soon ready to abandon their new undertaking. This resulted in the more confident growers leasing a number of orchards which were the more promising, thus adding materially to their already extensive acreage. These farming and horticultural operations require a small army of laborers to accomplish the work in field and orchard; but everything goes forward with smoothness and in a systematic manner.

Nowhere in the state is there more heed given to the requirements of the soil in heavy crop production. Both cultivation with cover crops and mulching and a combination of these methods are practiced with success. There is no partisanlike adherence to any certain or set plan of orchard management. A method which will conserve and improve the productive capacity of the ground is looked upon with favor. Good culture by one or more of these means, thorough spraying and systematic and courageous thinning of fruits, is the slogan in the valley of the Maumee.

The great business carried on by these representative Ohio horticulturists; their personal familiarity with conditions existing in various sections of our own and other states, from extensive travel and mingling with soil culturists in institutes, conventions and societies; their liberal mindedness in recognizing the obstacles to be overcome by culturists who work under very different environments, have so broadened their views of horticultural requirements in the different parts of Ohio as to render them in sympathy with all classes of growers who labor under these diverse conditions. Thus have they come into possession of those qualities which combine to produce true, earnest, helpful horticultural teachers. A substantial increase in the number of such men in our own and other commonwealths would rebound to the steady advancement of horticultural interests and practices everywhere.

It is interesting to note that, in the northwestern portion of Ohio, represented by Lucas and Wood counties, we find topographical, physical and climatic features very different—almost opposed to those observed in the central, eastern and southern areas of the state. Each section, however, possesses certain attributes which render it a worthy competitor of the other, in fruit production; and, as well, each has its drawbacks which make it incumbent upon the horticulturist to study local as well as general requirements in orchard and garden practice.

It has been the privilege of the writer to accompany the orchardist of the Lake Erie belt to the steep, rugged, orchard-covered, sunny hill-slopes of southern Ohio; likewise to accompany the orchardist of the rough, Ohio river section, to the floor-like levels

of the northern Ohio fruit districts. The first shudders with fear and expresses misgivings as to personal security as he rides through rocky, rough ravines and over dangerously steep and gullied hillsides and compares these features with his level ground and straight rows at home. The second studies with wonder and admiration the novel features of orcharding in the north, but soon tires of the monotonous levels and hails with exclamations of relief and delight the sight of the hills as he is hurled homeward on his south-bound train.

EFORTS TO CONTROL PEAR BLIGHT IN NORTHERN OHIO.

After a period of discouraging experiences with pear blight, during which thousands of valuable trees withered and died and other thousands were more or less mutilated in cutting away the terrible disease, growers of this excellent and desirable fruit, in northern Ohio, are meeting with a degree of success that inspires a bit of old-time confidence in planting anew as well as endeavoring to renovate and restore the old.

As mentioned in another chapter of this report, the erstwhile general orchard practice, in this northern section, was annual plowing and clean cultivation. When the scourge of blight fell upon the orchards the devastation wrought was apparently severe in proportion to the excellence of culture and fertility of the soil. This introduced a lesson in horticulture that was novel in the extreme. The less careful grower—the one in whose orchards a sprinkling of weeds or grass was not infrequently found, or the one who, through necessity, or otherwise, allowed the practice of annual plowing to "skip a cog" now and then—suffered less from blight than his more scrupulous neighbor. Here, indeed, was a lesson worth noting; and it was one that the wide-awake grower pounced upon. This was not without some misgivings however. It required courage of a special quality to ignore the traditional earmarks of the careful husbandman. The discontinuance of cultivation, the sowing of the orchard area to grass; the development of a true sod; the substitution of the mowing machine and the scythe for the cultivator, harrow and hoe were likely to be branded as evidence of fanaticism if not of insanity.

Prominent among the first to break away from old methods was a studious orchardist of Ottawa county. He had suffered severe loss through blight. His orchards were rapidly trending toward destruction. At this critical time he sowed a part of his orchard to

grass. A check in the growth of the trees was noticeable the following season and a corresponding check in the progress of the disease was noted. Cultivation on the other part of the orchard was later discontinued with like results. Today there is still to be seen a remarkable difference between the two plots, in favor of the one in which cultivation was first abandoned. Cutting out the dead and diseased branches had been done, though at first without close regard to details.

With the advent of San Jose scale the lime-sulphur treatment of orchards was introduced. This, together with persistent cutting out of blighted twigs and branches availed still further in control of the scourge. Partial success stimulated a more careful study of the definite history of the bacterial disease. Many cankers which were existing as sources of infection, and which had been responsible for continued outbreaks, were discovered and cut off or pared down and treated with fungicides. The trouble still further diminished. Planting of young trees was resumed and these, for the most part, lived and are now growing and approaching the fruitful age.

In all this discouraging experience, this orchardist did not seriously contemplate the substitution of varieties of greater resistance to blight. Had he done so, his alternative should have been to plant Duchess, Seckel or Keiffer as these are representative of the resistant class. The Duchess is not a profitable bearer as a standard tree; the Seckel is too small; the Keiffer is too poor in quality. His favorite variety was and is the Bartlett. Bartlett he would grow were such a thing possible. Inasmuch as Duchess had survived the blight and seemed resistant to a high degree this "tip" from nature suggested using this variety as a stock upon which to top-work Bartlett, thereby eliminating at least the graver danger of body blight or canker. A considerable block of Duchess was planted and has been successfully top-budded to Bartlett. This young orchard, at the time of the writer's visit in July, was the picture of health and vigor, and will, in another year or two, be bearing freely.

This grower, while achieving a measure of success is not exhibiting over-confidence in blight control. He only states that it is his belief that he is making progress and he hopes in the near future to be able to control the disease as are other troubles of the fruit grower, which, a few years ago, seemed beyond control.

At the time of the writer's call at this place, there was a trusted man in the pear orchard cutting out blighted twigs and branches and seeking for and summarily dealing with more or less obscure

sources of infection. The tools were sterilized, after each treatment, by being dipped into a weak solution of corrosive sublimate.

From the crop of smooth pears in sight, there was abundant evidence that the thorough lime-sulphur sprayings; the persistent removal with sterilized tools, of all diseased parts; the subsequent summer sprayings with copper compounds for scab of foliage and fruit and, withall, the eagle-eyed vigilance in seeking out and eliminating first evidence of the trouble, is enabling this orchardist to secure the merited reward.

THE HOME OF THE GRASS-MULCH METHOD OF ORCHARD CULTURE IN OHIO.

While not generally spoken of as a special horticultural section of Ohio, the table land bordering the valley of the Olentangy or "Whetstone" river in southern Marion through Delaware and in northern Franklin counties, exhibits possibilities in fruit production second to none in the state. As a nucleus about which the lesser horticultural enterprises are scattered, and representative of what might be accomplished in central Ohio, is an excellent apple orchard near Delaware, which has the distinction of being the home of the *grass-mulch method* of orchard culture in Ohio.

The life history of a great-hearted man, of a farm and of a system of orchard management which has become widely known by professional horticulturists in this and other states, is intensely interesting; and it is a matter of regret that this history, in full, cannot be given in this report. It can only be stated here that this farm was hewn from the virgin forest; that in that work the present owner, then a boy, actively assisted his father, driving the teams of oxen during the several seasons of heavy, wearing labor in "logging off" the ground; that, later on, the place became one of the foremost Short-horn cattle farms in Delaware county; that pasture fields of blue grass took the place of the forest; that for forty years some of these pasture areas, in which the plow was never introduced, were storing up plant food and developing into veritable gold mines for the future use in which they should be utilized; that the old, home orchard—a part of which remains and is now 55 years of age—annually threw out hints as to the possibility of apple growing in the valley of the Olentangy; that these hints the younger man, a lover and student of nature, from his boyhood, accepted as personal suggestions.

Twenty years ago one of the greater, blue grass pasture areas was set to apples. The sod, however, was unbroken save by generous excavations for the individual trees. Nature had suggested to

the planter that these trees should be given, as nearly as might be, the conditions under which flourished the great forest trees with which he was so familar in his boyhood. If the accumulating, decomposing, protecting, moisture-holding carpeting of leaves could produce so great and grand a forest growth why should not fruit-bearing trees take kindly to the plan?

The young trees were mulched with strawy manure or litter at the time of planting. Thereafter the grass was cut and placed about them—widening the circle each year as the tops of the trees extended wider and wider. Little cinder-heaps were thrown about the bases of the trees and protected them effectually from the mice. This is a familiar story to many planters, large and small, who are following the grass-mulch system in many quarters of our state.

In a typical grass-mulch orchard.

The results of the method originating on this farm compose an interesting, true, successful, happy, serial story which is yet continuing with increasing depth and breadth and strength. It is a horticultural story over which the professional horticulturists of the country disagree and spar and hedge; yet they are one and all compelled to admit that the method is still winning success on this farm

and placing it in the foremost ranks of its kind of our country. This apple orchard, twenty years planted, has borne thirteen paying crops of apples. Twelve of these were consecutive crops without a season's break. Then there was a skip of one season, 1907, because of the killing of the blossoms by a late, spring freeze. This season, 1908, after one year's rest, the great storage rooms are filled to their full capacity. Upwards of 15,000 bushels of apples were harvested from the fifty acres of orchard. Not one percent was injured by the codling worm; there was scarcely any scab. Thorough spraying together with ideal cultural conditions afforded by the grass-mulch returned a crop that is worth a small fortune in itself. The trees are the picture of health and vigor and promise for the future. The orchard area is cleanly and softly carpeted with its smoothly clipped, dense matting of blue grass. No weather conditions which bring mud and slush and water are too bad to prevent one getting about the orchards with clean boots.

Thus has not only success been achieved in this unique and original plan of orchard management, but a lesson has gone forth from this farm which is living, growing, spreading and gaining favor wherever it has been fairly tested. The plan which has rendered it successful has helped in the solution of the cultural problems of many growers, great and small, less favorably situated.

The owner successfully stores his great crops of apples in private storage houses in the midst of his orchards. A lesson from his work and attainments in this line is not less valuable than from his cultural methods. In this feature of storage the independent thought and originality of the man is again quite manifest. As in cultural work, the chief and peculiar value of his plans lies in their practicability for the farmer and the small grower, as well as for the large orchardist.

The visitor at this fruit farm may observe, first, ice storage with the regulation, overhead ice chamber; second, a combination of ice and cold air ventilation with the ice boxes in the storage room; third, the cold air ventilation system alone.

It is not necessary here to explain the ice storage, as it is the system generally in use in all private storage plants. This is used for holding the early ripening varieties of apples—those maturing before the season of cold frosty nights comes, which renders possible the utilization of cold air for securing and maintaining a sufficiently low degree of temperature to safely keep the fruit.

The combination of ice and ventilation is an interesting plan and practicable for all who have access to ice in moderate supply. This system has been installed in the basement of a great barn.

The barn was built on the summit of a knoll. The excavation for the basement cut entirely through this knoll, leaving similar approaches and elevations at the two ends, and ample room to drive through from end to end with team and wagon. In addition to the semi-cellar-like conditions obtained by this plan, the basement walls and ceiling were papered and ceiled, leaving dead air spaces, and the floor cemented. Previous to putting in the apples (which are all stored in crates), a good grade of building paper was spread upon the cement floor also, as this had been found to prevent withering of the fruit which came into close contact with the dry, moisture-absorbing surface of the cement. The ice storage chambers, of which there are two, are probably 12x12 feet square with a height of about 8 feet, and are located some distance from either end of the storage room. There are open spaces of a few inches beneath these boxes, from which issues, driven by the accompanying system of ventilation, the cold air which leaves the under surface of the ice boxes. The warmer air, as it rises, is carried off through openings in the ceiling. The openings at either end of the basement are provided not only with tight-fitting doors but with heavy, wire screens. Previous to and during the season of picking the later keeping varieties of winter apples which are held in this storage, the tight doors are thrown open during cold nights, leaving only the wire screens. The circulation of the cold air from the outside cools walls, ceiling and floor of the storage room. The tight doors are shut during the higher temperature of the day time. The inside temperature is thus gradually lowered, assisted by the ice boxes. A temperature of from 38 to 40 degrees can be maintained in late autumn and early winter and a still lower temperature after cold weather comes. A dangerously low temperature in cold weather is rarely attained because of the earth-warmth of the central, "below-ground" portion of the basement. At the time of my more recent visit, November 13, 1908, there were about 8,000 bushels of fine apples in this storage—all neatly and compactly stored in crates.

A third storage, also utilized in the preservation of the later sorts of winter apples, is cooled by cold air alone. The walls of this building are double and constructed of hollow brick. The space between is filled with mineral wool. The owner states that if he were to build again the construction would be a frame one with double walls and the intervening space left empty. The building is set up off the ground a few feet. In the foundation are several openings or windows provided with tight-fitting shutters. In the floor of the storage room are four long, narrow openings covered with heavy, wire screen. Ventilating shafts extend from the ceiling to the peak

of the roof, which may be opened or closed at will. This storage room is cooled down at approach of apple harvest by opening the cellar windows on cold nights; the ventilator shaft to the roof is also opened. The cold air rushes into the cellar and up through the openings in the floor to take the place of the warmer air which escapes through the ventilating shaft at the ceiling. The room becomes very cold during the night. All openings are kept closed during the day time when the outside temperature is warmer. This storage has done very satisfactory work.

From the last described system of cold air ventilation there are few home owners but who can obtain ideas which should enable them to convert some out building, basement or barn cellar into an excellent storage room for winter apples, potatoes and vegetables.

As usual, on my visit of inspection to this fruit farm, observation was made of the methods of orchard pruning in practice. The owner favors low-headed trees. He is a disbeliever in unnecessary, heavy pruning, or restriction, to keep the trees within bounds as to size. He prunes about once in three years, thinning out the branches which are becoming too thick. With his low headed trees the upper, side branches are gradually extending outward from successive annual growths and are year by year pressed closer and closer to the ground by their weight of fruit. Retaining this position to quite a degree the lower branches are gradually overshadowed and smothered out by those above through cutting off of the sunlight. These lower branches are then removed.

When large branches are removed, they are cut off at a distance of perhaps 18 inches from their base, leaving a stump of that length. This practice frequently brings our friend into argument with professional horticulturists; but the vigorous manner in which he defends his ideas and the illustrations in the orchard which he points out, are quieting if not convincing. He contends that the removal of a large branch by sawing close to the body of the tree invites decay, while by leaving a stump of a foot or more, the stump dries or seasons out hard and sound and remains for many years without decay. He points out certain trees damaged and decaying through close cutting of large limbs. The argument is "clinched" by leading the visitor to a large and old apple tree which now has a hen's nest in the hollow resulting from the wound caused by close cutting of a large branch.

The writer agrees heartily with this orchardist on several important features of orchard work, but we cannot quite get together on the subject of pruning. It has been proved that large branches

can safely be cut reasonably close to the body of the tree if the wound be sterilized with a solution of copper sulphate, corrosive sublimate or carbolic acid, and given a heavy coat of lead and oil paint as soon as the solution has dried. The result is much more sightly, and heals over in time.

Another excellent orchard practice noted in this apple orchard was the treatment of trees which were splitting or threatening to split down from their burden of fruit or as a result of heavy wind. There are purchased what are known to the trade as "lag" or "coach" screws—large, square-headed screws which can be gotten in various sizes. Those preferred are six inches in length and three-eighths of an inch in diameter, which I find are priced at $1.28 per 100, or 20 cents per dozen. A blacksmith turns a hook at the head-ends of the screws. Holes are bored in the two parts of the tree which are separating, in which the screws are solidly turned, connecting them with a heavy wire cable. The screws should be given such a position that there will be a "straight pull" on them, thus eliminating danger of splitting the branch. The cable is formed by using two "rounds" of heavy, galvanized wire from hook to hook, which is then twisted up taut by inserting between the wires a piece of buggy spring or other flat piece of iron or wood, and turning until the divisions of the tree are brought in close contact at the point of separation.

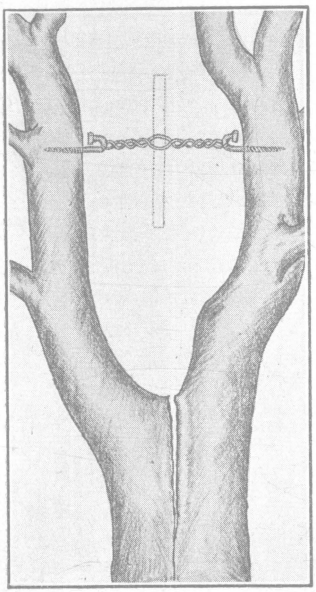


Fig. 6. Repairing a tree injured by wind or too great weight of fruit.

A PROMISING ORCHARD IN SOUTH-CENTRAL OHIO.

It is always gratifying to those engaged in Experiment Station service to be able to take up those lines of work which promise to appeal to the private culturist. It is pleasing to know, from the private worker's own lips, that such experimental work has helped to solve individual problems on the farm or in the orchard or garden. These words of commendation, it is good to affirm, come occasionally to the Station's Horticultural Department; they are much appreciated, as they tend to lighten burdens and brighten lives which are being earnestly devoted to the cause of horticulture.

It is especially gratifying, even though the knowledge is sometimes tardy in reaching us, to find that here and there, within our state, studious men who observe the Station's work very closely through its publications, are carefully, though quietly, following its advice, benefiting by its failures as well as successes, and escaping loss by its timely admonitions.

An illustration of this quiet, confident following of our Station's experimental work, takes us, for a short time, among the hills of western Muskingum county, which locality is typical, physically, of conditions prevailing in the hilly sections of south- and east-central Ohio.

In August, 1908, a gentleman who is a well-known physician of Cincinnati, wrote from his old home at Hopewell, Muskingum county, where he was spending his vacation, reminding me that we had met at the Troy meeting of the Ohio State Horticultural Society, in 1900, at which time he was becoming not a little interested in fruit growing as a commercial proposition. He extended an invitation to the writer to visit the old homestead at Hopewell and see what had been done since the year 1900. This invitation was accepted and resulted in a visit early in September, 1908.

Fig. 7. A promising young orchard in which the grass-mulch method of culture is faithfully followed.

The correspondent's seven-year-old orchard is situated south of Hopewell, a village on the old National road, nine miles west from Zanesville. This is one of the high points of the state—the elevation as indicated by a recent geological survey, at one corner of the

orchard, is 1126 feet above sea level. This particular elevation forms the water-shed or "divide" between the little streams of water flow ing north and north-east to the Licking river and those flowing south to join the Moxahala or "Johnathan's creek."

Here was found, in a section where there is little interest in orchard planting, one of the finest and most promising young apple orchards which it has been my privilege to examine in Ohio. Here were growing over 2000 trees of four varieties—York Imperial, Rome Beauty, Grimes and Ben Davis—all scrupulously neat and well kept under the sod-mulch or grass-mulch system of culture, of which this orchard is an excellent example.

The owner's experience in starting this hill orchard and attempting to cultivate for the first few seasons, would serve as an admirable lesson to those who refuse to recognize anything but persistent, annual plowing and cultivation. The surface of the orchard area is all sloping; much of it is quite steep. Various exposures are represented—all inclining toward a low depression or ravine having its exit at the south-central limit of the field. The character of the soil is almost as varied as are the exposures and is representative of a large portion of eastern and southeastern Ohio where the various strata, through erosion, exhibit their different, decomposing layers on hill slopes. This section embraces the western limit of the bituminous coal fields underlying eastern Ohio, and an excellent grade of this variety of coal underlies this farm where coal mining for local consumption has been in progress many years.

The field, previous to planting to apple trees, was covered with an unsightly growth of briars, shrubs, weeds and mixed grasses. The ground was cleared off, plowed and prepared as for a field crop. The trees were set and a crop of corn grown between the rows each of the first two seasons. At the end of two season's cultivation the mistake made was only too apparent. Great gullies were being cut and a serious loss of soil sustained by washing during heavy rainfall. Clearly this would not do. Something must be done to check the frightful erosion. A sod must be grown or the orchard would be lost and the ground ruined for all time. A vigorous effort to secure a catch of grass was made, extending throughout the next two years, when success was finally attained by fall seeding. An excellent carpeting of timothy and clover and mixed grasses now covers the ground. This is cut and used for mulching the trees. In the better portions of the orchard this growth is not only sufficient to heavily mulch the trees in that section, but there is some material to spare to be used in the thinner places. If there be not

enough grass to mulch all trees thoroughly, straw or other material is brought in from other sources and every tree well mulched. The entire orchard would be a credit to any experiment station as an example of the grass-mulch plan of culture.

There was much difficulty experienced in getting the gullies stopped which had been cut by the water during the two seasons' cultivation. Many loads of brush and other coarse material were hauled in to fill the channels which were too wide and deep to be safely crossed by a team. Even stones and soil had to be hauled to restore and hold young trees which were literally "washed out by the roots." Trees that had been undermined and had fallen toward the gullies and which had been pushed back and blocked with soil and stones and brush, were pointed out. One of these trees is shown in the photograph accompanying, after the gully has been filled and grassed over—the second tree at the left hand.

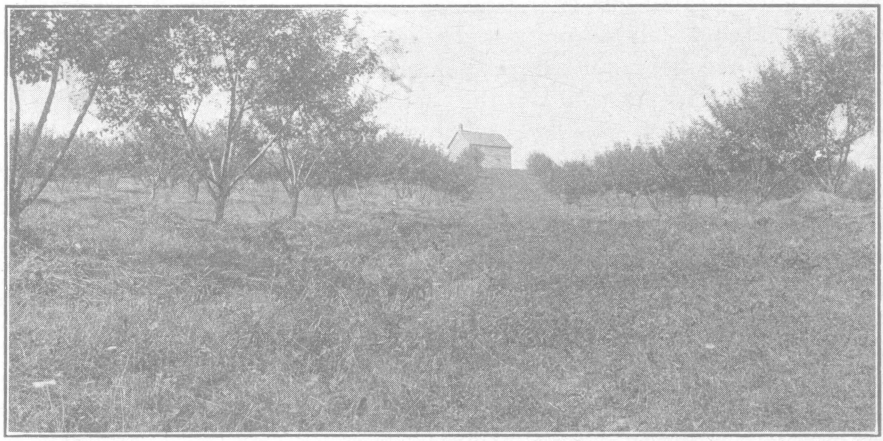


Fig. 8. Where great gullies formerly abounded.

An experience of this kind would be a valuable educational feature to the advocate of persistent plowing and stirring of the soil, who never learned the lessons which our steep hill-sides are capable of "rubbing into" the student horticulturist. It is simply folly of the grossest sort to recommend cultivation under such conditions.

Considerable trouble has been experienced in this orchard from the work of rabbits, wood-chucks and field mice. As usual the mice are the more destructive of these enemies. Mounding with soil, cinders or fine coal screenings from the nearby mines is now practiced with good results. The effect of partial girdling by mice, becoming apparent by the early and heavy fruit-bearing of the trees

most injured, is to be seen here and there. The orchard as a whole is now beginning to produce a small quantity of its first fruits; but the partially girdled trees were this autumn bowed to the ground by their heavy loads of highly colored apples. Many of the trees injured promise to outgrow the wounds; some will die. There will probably not be further injury done as mounding is now to be done annually.

There are not a few neighbors of this old homestead who are inclined to smile at this venture in orcharding in a section where commercial fruit growing is practically unknown. But, with the present good care, the time is not far distant when this same orchard will be an object lesson in successful commercial apple culture in its vicinity and among the leading ones of its kind in Ohio.

Conditions in Muskingum county are similar in many ways to those in southern Ohio which is noted for the beautiful color and fine quality of its apples. In some respects south-central and east-central Ohio are superior to the extreme southern or eastern parts, for apple culture. The elevation above sea level is as great or greater; the hills are not so extremely steep; the soil, as a rule, is better and more productive; the trees make a larger growth and are longer lived; and, on the sunny exposures of the hillsides and tops, the coloring of the fruit and the quality are fully equal to that attained in more southern areas of the state.

The only criticism which I should care to offer in relation to orchard practice observed at Hopewell is the plan pursued in "pruning up" the young trees. The lower branches have been pruned away, leaving those of more upright growth to form the heads of the trees. The young trees are low-branched, naturally, which will enable them to outgrow the effects of this pruning up in a few seasons. True, the time would come when these lower branches would have to be restricted or perhaps pruned away entirely; but they might well be allowed to remain until the branches above, through being borne down by weight of fruit and set in that position, have so overshadowed and crowded them as to render them of no further use either in shading the body of the tree or in fruit production.

HORTICULTURAL ACHIEVEMENTS IN SOUTHERN OHIO.

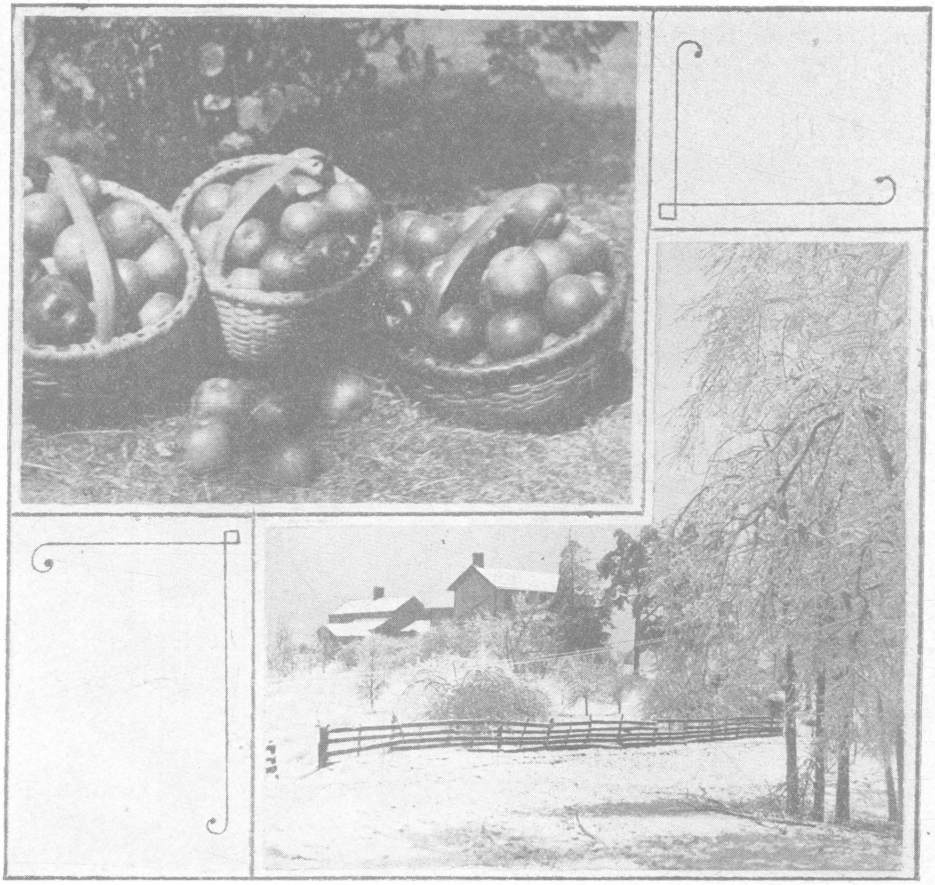
Mention has been frequently made, in this report, of the prominent place in fruit culture occupied by the southernmost part of Ohio. While it has not, at any time, even been suggested that a recital of orchard practices in this extremely hilly section could be of material benefit to the well and modernly equipped orchardist of northern Ohio fruit districts, there are yet lessons to be learned

concerning the peculiar resources of our state; the fidelity of some of her citizens to environments which have been their inheritance, and certain methods which, if one-half so faithfully observed, should bring success to the smaller producers in the central and somewhat less hilly areas.

The extremely broken character of this section, physically, is evidenced by the fact that there is an oblong-oval tract of land some 24 miles wide by 40 miles in length, extending lengthwise north and south, which has not, as yet, been penetrated by a steam or electric railroad line. This tract embraces the larger portions of both Lawrence and Gallia counties. The rough character of the surface of this land cannot be said to be caused by "high hills;" more properly it is due to its deep, steep-sloped ravines caused by erosion—the cutting down and wasting away of the land by the excavating power of the Ohio river and its numerous smaller tributaries.

The surface of the country now embraced within the lower three-fourths of Ohio was, in earlier ages, practically a monotonous plain with a very gentle slope southward from the watershed or divide—a ridge extending from the north-east part of the state south-west to a point midway of the north-and-south, Ohio–Indiana boundary line. The hills in this southern Ohio section are not, therefore, of greater elevation above sea-level (they are slightly less) than those farther north. The erosion or "washing" has only cut deeper, sharper, broader depressions which cause us to exclaim at the apparent height—the dangerous steepness of the hills. The magnitude of these depressions or ravines can best be realized through a simple illustration: At the writer's country home in south-central Licking county which is very nearly the central point in Ohio, there is a flowing spring of water which is one of three forming the source of one of the creeks tributary to the Licking river. This spring is at an elevation of about 1025 feet above sea level. The little stream flowing away from this source can be followed in a very winding course to the Licking; the Licking to the Muskingum; the Muskingum to the Ohio; the Ohio to Huntington and Rockwood at the southern point of Lawrence county. In all this meandering course of fully 250 miles via Zanesville, Marietta and Pomeroy, the waters of the little stream are constantly flowing to a lower level. The fall is slight in places, in others it is abrupt; but it is ever dropping lower and lower. Yet the summits of some of the southern Ohio hills are but slightly less in elevation above sea level than the source of the little stream in central Ohio. The descent from these elevations to the

bed of the Ohio river opposite Huntington is difficult of conception save by the personal observer. We are told that the loftier hills which may be sighted from the river range from 200 to 600 feet above its bed.



Photos by Ethel Cox.

Rome Beauty apples The old Homestead of Nelson Cox, deceased

Strange to say many of these steep hills were early denuded of their timber and cropped to their fullest capacity for many years subsequent to the civil war. But, as the humus or decomposing vegetable matter with which the virgin soil was filled, became depleted by indiscreet cultivation, the soil was more and more readily swept away from the steep inclines by the washing rains. Stripped of the protecting forest growth the terrible erosion characteristic of former ages was again resumed and in many places is yet continuing.

The rougher hills of southern Ohio do not present the beautifully rounded outlines of those in more northern regions of the state; many of the steeper slopes expose barren, yellow areas slashed with gullies; others are covered with briars, shrubs, weeds and thin growths of mixed grasses. Small areas here and there still support original growths of native timber; and these suggest the part southern Ohio hills might be playing in the commercial world today had they not been carelessly and wastefully denuded. Other areas are slowly reclothing themselves with forest growths. Among these the Black Locust is conspicuous and is producing great numbers of posts for a ready market.

It was in 1854, before the timber had been so largely removed from the hills; before there had occurred so great a waste of the resources of the soil of the hillsides, that Nelson Cox came across from Cabell county, West Virginia, settled in Lawrence county and laid the foundations of the fruit growing industry in southern Ohio. Eminently successful, respected and honored by all who knew him and living to the age of seventy-four years, he was privileged, prior to his death which occurred October 30, 1902, to see gathered over 3000 barrels of beautiful apples from trees planted by him on the old homestead.

Southern Ohio orchards are scattered over the steep slopes and towering summits of hills such as I have endeavored to describe. At first sight they are disappointing to one who goes to this section from the northern fruit country expecting to see great blocks of uniform trees in straight alignment up, over and across the hills. Such planting is not practicable here, no matter how desirable. So steep is the ground that, to enable the orchardist to get about with cart, wagon, sled or mower, the rows must encircle the hills, preserving as nearly as may be, a right angle to their slopes. Even then, in the more dangerously steep places, a furrow is drawn between each two rows of trees, in which to run the upper wheels of wagon or spraying outfit to prevent overturning. Moreover, on account of the fact that on this character of ground the trees are comparatively short-lived, replanting must continually be in progress. All orchardists know that loss of trees and replanting soon breaks the uniformity of the most sightly orchard plantation. Loss of trees and replanting here, however, do not mean as many years of waiting as is the case in the more northern sections, where the soil is stonger and where the impulse of wood growth, for the first few years, precludes the possibility of early fruit bearing. Just what peculiar quality it is, possessed by this thin ground of the southern Ohio hills, which coaxes newly planted

trees almost immediately into fruit-bearing, I have never heard satisfactorily explained. This, however, is true; and it is not unusual to see small, shoulder-high apple, peach or plum trees, bearing great well-formed specimens of their kinds, entirely out of proportion to the diminutive trees bending under the weight of their burden.

The standard of orchard cultivation, in this section, is not that which quite satisfies the scrupulous culturist, cover-cropist or grass-mulchist of more easily travelled orchard areas. But the considerate, sensible horticulturist will concede that it would be difficult to introduce a method that would safely combine the essentials of thorough, cultural practice. It would be the height of folly even to seriously think of plowing such hillsides. Gullies which are with difficulty held in check are already in evidence. In rainy seasons every inch of soil loosened by successive cultivations would eventually add its contribution to the delta of the Mississippi, leaving the hillsides stripped of the little organic matter which many seasons have been accumulating. Mulching, while desirable in the highest degree and successful on the hills wherever it has been tested, presents grave difficulties in this hilly section where practically no grain is grown, hence no straw procurable within reasonable distance. Straw may be purchased over in the valley of the Ohio, but the price is high and the eight or ten or more miles of rough, hilly roads are a barrier to transportation. Straw, even under these expensive conditions proved, in an experiment under the direction of the Experiment Station, to pay well when applied as a mulch. Eight dollars per ton were paid for this material for mulching. The trees thus treated suffered less from drought, held their foliage better and perfected finer crops of fruit than adjacent trees not so mulched.

The thin, orchard soil, as a rule, does not produce a sufficient growth of grass to make an effectual mulch for the trees, when cut with the machine or scythe; it is clipped once or twice in a season and allowed to remain where it falls. This seems to be about the only course open to the orchardist of this hilly section. To the credit of these orchardists they do not claim that they are thus following the true grass-mulch method, as have certain others who pursue this plan of orchard management; they are merely doing the best they can under the conditions with which they have to deal; and the peculiar environment among these rugged, sunny hill-slopes, brings generous response for their arduous labor.

No definitely outlined system of pruning is followed in this section; and little pruning is done as compared with the more northern fruit country. Indeed much less pruning is required

here where the trees come into bearing at so early an age. Fruit bearing at once checks, equalizes and distributes uniformly over the tree the production of new wood—thus shaping at a very early age a mature form of tree. This early maturity in form and precociousness in fruit bearing would, in the more northern latitude be regarded as prematurity—as abnormal—and we should at once be led to examine the base of such a tree for borers, injury by mice etc.; for only a girdled tree, in central or northern Ohio, presents this phenomenon of early maturity and abundant fruit production which are brought about by quite natural but little understood causes in more southern parts. In the north, on rich soil, the annual growths of wood are so rampant and upright, and fruit-bud formation so much longer delayed that more or less restriction of growth must be resorted to in order to hold the heads of the trees within reasonable bounds vertically and laterally. Such restriction by pruning means a multiplication of shoots and these, in turn render thinning of branches necessary.

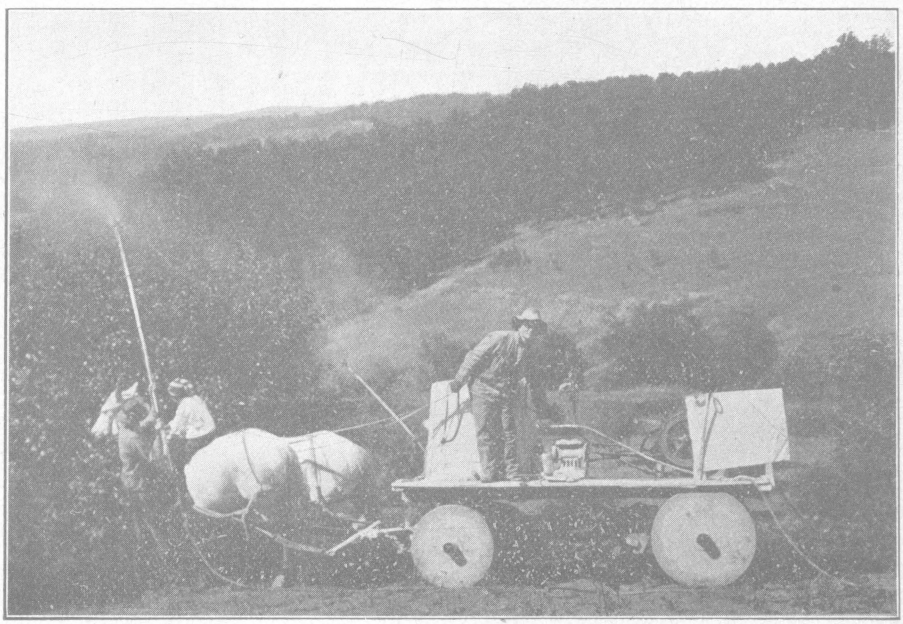


Fig. 10 Spraying apple trees among the southern Ohio hills. *Photo by J. S. Houser*

The writer has a half-dozen trees of the Ensee apple, in Licking county, six years planted, which were propagated in Southern Ohio. These trees have not yet borne a single specimen of fruit, nor has

it been expected of them; but very small trees of this variety, not half so long planted, were seen this season (1908) in Lawrence county bearing one or more fine apples. The same tendency to early bearing is found in other classes of fruits.

The apple trees of this southern area are, as has been before stated, comparatively short-lived from early, profuse and regular fruit bearing. In consideration of these facts it is clear why a well defined system of pruning has not been developed in this section.

It cannot be marvelled at, therefore, that the energy of the southern Ohio apple grower is largely expended upon spraying and thinning. These constitute the secret of success aside from the peculiarily propitious, natural properties of soil and climate. Faithful devotion to spraying atones for any compulsory omissions in culture or pruning. In spite of the dangerous and, in some places, well nigh inaccessible slopes, the gasoline spraying outfits are almost continually creeping around, over, up and down the rough orchard areas, dealing out death and destruction to insects and fungi infesting foliage and fruit. This brings soundness of fruit and that tenacious, "clinging" quality which keeps it on the trees until late in the season, permitting the southern Ohio sunshine in conjunction with the peculiar properties of the soil and elevation, to perfect the work of exquisite coloring for which the fruit of this locality is widely noted.

The Rome Beauty apple which reaches so high a degree of perfection in southern Ohio, originated in Rome township, Lawrence couty. Other seedling trees are found springing up throughout this older apple section. Emanating as they do, in many cases, from standard varieties of excellence, a number of these seedlings possess some merit. So far unapproached among these is the "Ensee" (N. C.—Nelson Cox) the seedling tree of which came up near the site of an old cider press on the old homestead. The tree stood and bore regularly and heavily, for years, near the barn. The writer was privileged, two or three years ago. to see this tree bearing a crop of over 30 bushels of fine apples. Soon afterward the barn burned and the tree perished. The "Ensee" in general appearance, somewhat resembles the Rome Beauty of which it may be a seedling; but the quality is vastly superior. It has won many prizes on the exhibition table, for size and beauty and for dessert quality.

FRUIT PRODUCTION FOR THE RETAIL MARKET

There is sometimes a tendency, in studying or describing the resources of a country or state, to patronize those sections and press to the front those firms and individuals which are most extensively engaged in the industries under special observation, to the neglect of the lesser enterprises of the same type which are in successful operation in many places. It is desired that, throughout the various chapters of this report, there shall be distinctly traceable a current of recognition of the simple interests of the home owner and smaller grower of horticultural products as well as of the greater industries of special horticultural sections.

Representative of the retail branch of the horticultural industry in Ohio, and of conditions and possibilities prevailing in the central portion of our state, there was studied a fruit farm located on the northern border of the valley of the Licking river, five miles north-east of Newark, Licking county. A brief description of this business is deemed advisable simply from the fact that such a recital may be the means of suggesting some point which may prove helpful to others who are endeavoring to build up a first-class retail trade in other markets of the state.

It is the purpose at this farm to be able to offer to customers, throughout the entire year, the choicest fruit products of the soil, put up in the most attractive form. A diligent study is made not only of the principles of horticulture and soil management, but of varieties and types of the different classes of fruits, which embrace those superior attributes which satisfy the more exacting. As a result of this study not only is the standard of excellence in various products steadily and surely promoted to a higher plane, but there is a corresponding educational advancement of the patrons who year by year more fully appreciate the difference between the superior and the inferior and are willing to pay for that difference. No longer is an apple "just an apple" nor a potato "merely a potato" regardless of individual, varietal characteristics which combine to produce a good or a poor product; and it is this generally increasing distinction between high and low quality, and the fuller appreciation of the effort to place goods upon the market fresh and crisp and in neat and attractive and appetizing form, that render marketmen of this type (and there are many of them) successful at the present and hopeful for the future.

The market season opens, at this farm, with rhubarb and asparagus and continues throughout the year, including strawberries, raspberries (red and black), blackberries, currants, gooseberries, grapes, cherries, plums, peaches, pears, summer, fall and winter

apples, melons and potatoes. During the summer months the market stand is at all times brightened with out-door-grown, cut flowers of the various kinds and seasons. Chief among these are sweet peas, gladioli and dahlias. From the sale of flowers quite an additional sum is realized during the season, aside from the attractive feature they afford.

The retail market bench which represents such a farm never becomes a "bargain counter" in the generally accepted sense of the term. Great quantities of produce are sold to the consumers and always at the highest, prevailing market price. Many private orders are taken for considerable quantities for home use and the delivery of these larger lots, together with a brisk wholesale trade with a number of the leading grocery firms, render busy the days intervening between the semi-weekly markets.

Fig. 11 A central Ohio strawberry field

Central Ohio horticultural conditions, fairly well represented by this farm and business, are favorable to the production of nearly all classes of fruits. The exceptions should, perhaps, be peaches and pears which flourish only in certain small areas where soil and climatic conditions are exceptionally good. "Peach yellows" and "fire-blight" of the pear make the growing of these desirable fruits most discouraging. These diseases seem especially virulent in

central and southern Ohio. At the farm visited the owner has recently cut out many peach trees which were just attaining fruiting age, while pear trees are blighting and dying upon every hand. Whether the generally prevailing light, gravelly nature of the soil is, in part, accountable for this serious loss of pear trees, is a question which suggests itself. The land, part hill and part level, includes sections of both the sharply sloping coast and the comparatively level bed of a great prehistoric lake which covered what is now an extensive area in central Licking county. This, together with the fact that it is quite near the southern limit of the glaciated area of the state at this particular point, probably accounts for the peculiar and gravelly character of the soil.

The orchard areas include the steeper exposures of the hill section of the farm. Of necessity some form of orchard culture that would conserve the soil itself as well as the soil moisture, had to be adopted. The fruit trees, on the hill-sides, occupy strips of grass-land extending along or around the slopes and at right angles to the direction of the descent. The grass growth is clipped from these strips and utilized, so far as it will go, in mulching the trees. All other surplus vegetable or weed growth is utilized in like manner. Straw is also purchased for mulching trees and strawberries.

Bush fruits are largely grown between the tree rows—these intervening strips being cultivated during the earlier part of the season and sown to some cover-crop later on. Potatoes and melons are also crops grown between the tree rows and are used in rotation with leguminous plants such as cow peas, or Canada field peas sown with oats. It is clear, therefore, that where plowing and cultivation of the spaces between the tree rows, on the hill-slopes, has been practiced, it has been done in connection with the growing of these as a money or a leguminous crop—both of which mean practically the same thing to the horticulturist. The strips of sod break and catch the wash of soil, and the repeated plowing of the ground—always turning the furrows downward—is gradually terracing the hillside and forming more level road-beds between the rows so that there will be less difficulty in getting about, in later years, with team and wagon or sprayer.

Independent bush fruit plots and the vineyards are cultivated annually, finishing each season's culture with the sowing of some cover crop to retain the soil and conserve and utilize such elements of fertility as would otherwise be lost through washing, or escape in gaseous form.

Grapes of most excellent quality are grown on the sunny, southern slopes, and afford a most attractive and tempting addition to the products filling the market bench, during a long season.

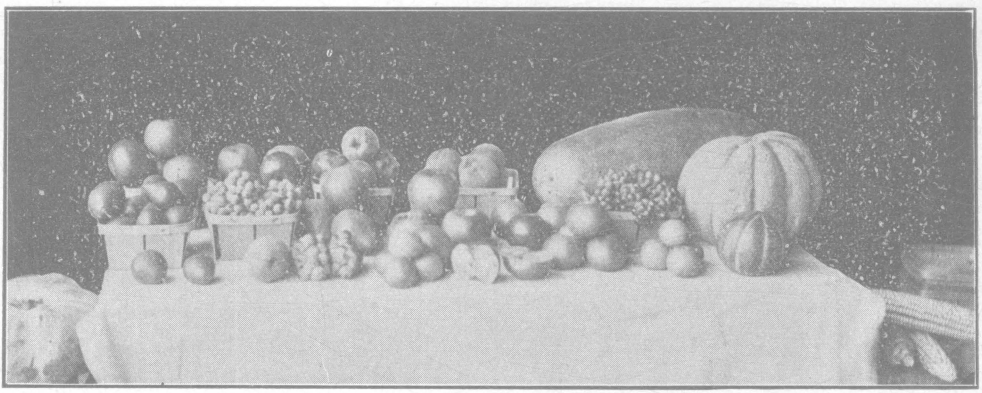


Fig. 12 From tree, plant and vine to consumer

Strawberries and potatoes are companion crops on the lower, more easily and safely tilled portion of the farm. A favorite rotation is strawberries, crimson clover and potatoes. In addition to the Crimson clover as a soil improver, and stable manure, commercial fertilizer containing a heavy percentage of phosphorous is giving excellent results with potatoes. In past years it was thought that late planting of potatoes, in the hilly section of central Ohio, would bring only disappointment and loss. The introduction of commercial fertilizers is causing a happy revision of that theory. Phosphorus in the form of "acid phosphate" so hastens development and maturity of the crop that potatoes, even of those varieties which are medium to late in season are now planted as late as June with good results. The season of 1908 exhibited the advantage of late planting, in central Ohio. The first part of the season was cold and rainy and the earlier planted potatoes generally showed much scab at the time of digging. The latter part of the growing season was quite dry; and while the June-planted crop did not yield so many tubers per hill, the individual tubers were of fine, large size, smooth, and unusually free from scab. They matured in ample time to be harvested before serious injury by frost. Eliminating the maturity-hastening element—phosphorus—from potato culture, when planting is done so late and in so dry a season, the product resulting, in this section, would hardly have exceeded in quantity the seed stock used.

As before intimated, good quality in potatoes is not less regarded than good quality in fruits. The reputation of this farm for high class produce is built, in part, upon the Seneca Beauty potato for which there has been developed an excellent private demand.

While the business of this farm is quite extensive for one from which retail marketing is made a special feature, yet it is so representative of what may be done on the smaller place in connection with the home market, that it is with pleasure that this chapter is added to our report.

In conclusion, it is often asserted, and reasonably, too, that fruit growing is fast drifting into the hands of specialists. With an ever increasing host of insect and fungus orchard enemies to combat, it could not do otherwise. This is providing we properly interpret the term "specialist." The question arising is—what are the characteristics of the "specialist?" If the "specialist" is supposed to be represented by growers both great and small, who intelligently and successfully plant, cultivate, prune, spray, harvest, pack and market their products of the soil, well and good. If the "specialist" is to be solely represented by those individuals or firms which conduct orcharding upon an extensive commercia basis, let our doubts assume the form of a protest. The time has not yet come when the wide-a-wake small grower cannot earn a comfortable living and a substantial home, if he have access to a good, home market, and he be willing to work with his own hands, while the extensive grower is building his fortune or a firm or company of growers earning satisfactory dividends upon their investment of capital. While the latter represents an essential factor in the production of the world's supply of fruit, the former is an equally important factor in the maintenance and multiplication of that class of country homes and enterprises which are the "backbone" of prosperity in the rural districts of our state and country.

PROTECTION OF TREES FROM RODENTS

In view of much inquiry submitted to the Horticultural Department of the Station, as to means of protecting orchard trees from the destructive work of mice and rabbits, observations have been made on the various trips in inspection service for the purpose of noting methods in use by large orchardists.

In those level parts of the state where orcharding is the more extensive feature of industry and, incidentally, where cultivation is practiced generally, there seems to be little trouble given by

rodents. An occasional tree may be gnawed by a stray rabbit, but these pests are by no means so numerous as in the hilly sections of the state, and little attention is given and few precautions taken to prevent the small loss. Banking or mounding the trees with cinders or soil, to prevent injury by mice was the only means of protection from rodents that were observed during the whole season of 1908, though orchards in several parts of the state were visited.

More in detail banking consists in maintaining at the base or about the "collar" of each tree a little mound composed of a few shovelfuls of cinders or of soil where cinders are not available. In case soil is used the little mound should be firmly "tamped" down each autumn and fresh soil added to round it up. Otherwise the old mound becomes burrowed full of holes during summer and affords good places of concealment for feeding mice in winter. Tamping, just before freezing weather, closes all burrows and compacts the soil so that no more will be made until after freezing and thawing is done the next spring.

It is evident, from correspondence, as well as through personal experience, that nine-tenths of the injury by rabbits and mice occurs in the small, isolated, home orchards, as surroundings are usually favorable to bringing these rodents into close proximity to the smaller, home plantings. In such cases the importance of some mechanical contrivance to keep the rodents away from the trees, cannot be over estimated.

A fully illustrated and descriptive bulletin is in course of preparation as a result of calls for help along this line.

THE OLD AND NEGLECTED ORCHARD.

There are hundreds, yes thousands of these in Ohio. The former owner was a lover of fruits. He gathered from various sources his trees and took much delight in planting and pruning. Many of these trees were of unknown and perhaps unnamed varieties. He did much budding and grafting of choice varieties on the trees composing his home orchard. He rarely cultivated; he did not spray; yet the rich virgin soil produced strong clean growths and the equilibrium of Nature, which had not yet been disturbed—thrown out of balance—rendered the problem of insect control a factor in fruit production not yet dreamed of. His children, as a rule, manifested much less interest in the orchard. They enjoyed the fruits which were usually in sufficient supply to meet their wants; but they gave little personal thought and care to the source of this bountiful supply.

There were few convenient markets of consequence demanding fruits and offering attractive returns which would awaken their interest in fruit growing as a business. Their thoughts and efforts were directed in other channels in pursuit of lucrative employment.

The planter under whose fostering care the orchard had flourished, reaches the zenith and proceeds onward toward the sunset of life. During his declining years the orchard, growing old with him, has had no special care. The great trees have grown beyond all anticipated bounds.. Some of them are dead; others are dying. Many scattering dead, broken and lodged branches render unsightly that which was formerly an object of symmetry and beauty. The owner dies. The mental record of interesting data relative to planting, care, crops and varieties perishes with him.

Fig. 13. Once the pride of a pioneer home.

A younger generation comes into possession. The old orchard is an eyesore. Cutting down and burning the trees is in contemplation. Yet there are a few fair specimens of fruit on the uppermost branches. Their maturity is awaited. The longest ladder proves by far too short to reach them. The danger to human life and limb is too great to attempt to climb for them. The axe and the saw are introduced as implements of the harvest. The great branches are sawed and slashed partially through. Gravitation accelerates the work of butchery. The heavy, fruit-laden

branches crash to the ground taking with them great slabs and splinters and strips of bark from the remaining, upright stumps. The fruit, bruised and crushed, is gathered up, unfit for anything but immediate use. The wreckage, complete, is left to be cared for later on; it will be used for fuel or allowed to remain as a temporary monument to the horticultural aspirations and attainments of the present generation. The ambition and enthusiasm in orchard ownership and orchard work which characterized him who has gone before has reached a low ebb in his offspring. Is there anything which can intervene to change the course of this progressive outrage upon nature—this willful destruction and absence of appreciation for the beneficent forethought and labor of the pioneer home maker? There is: "A little child (a little tree) shall lead them."

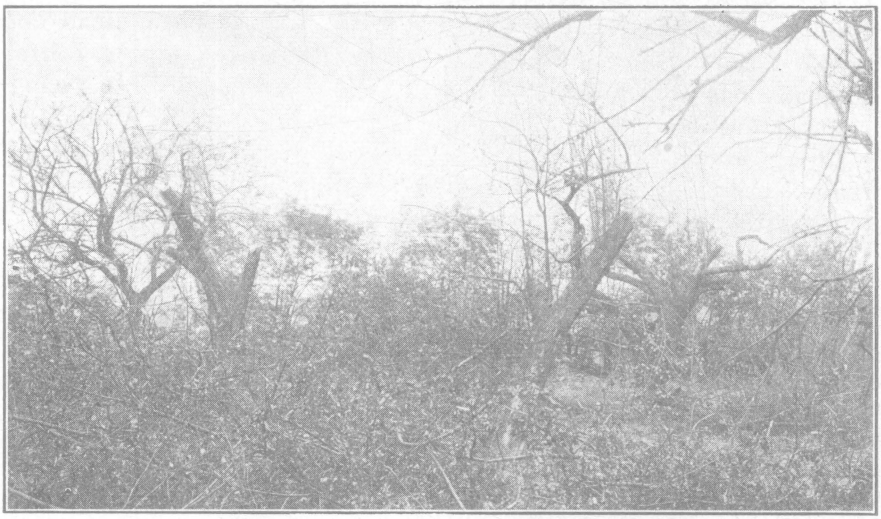


Fig. 14. A sad example of mutilation.

In following years, where a veteran tree had been chopped or broken off at the ground, new shoots have been annually springing up only to meet a hard fate from roving stock, or plow, or grubbing hoe, or scythe. By chance, which approaches the miraculous, a fortunate, vigorous sprout—a baby tree—from a decayed stump of a tree long gone, has withstood the vicissitudes of the pasture lot and attained the age of reproduction. Its first fruits instantly attract attention because of large size, excellent form and color and good quality. The dormant or scattered interests of the present owners are awakened and concentrated by this "phenomenon(?)" occurring on the site of the old orchard. What is this remarkable fruit? Is it a new variety? If so, a fortune at once shows its hazy

outlines in the indistinct future. Is it a new type of an old variety? Good fortune is still dimly seen to arise and shake herself. Is it an old variety, simply? If so, this particular location must be especially adapted to its production in the most excellent degree, else such great fruits would not grow upon so diminutive a tree. Good fortune is still in sight.

Who is there to help unravel this tangled problem? Some one has spoken of the Experiment Station. What is it; where is it; to whom should the communication be addressed? Help is called to assist in the identification of the variety newly fruiting, or in the determination of whether or not it is a new variety. Information is eagerly sought as to best means of propagating young trees of this particular species for planting. The previously little thought of processes of grafting and budding now become a special branch of education most seriously and earnestly coveted. Interest in all phases of orchard establishment and management is quickened into new life. Preparations are made for clearing away or thoroughly renovating the old orchard. New areas are chosen and staked out for the planting of young trees of this "special" and other varieties of fruits. All this, in progressive order, is the sequel of "the survival of the fittest" in the erstwhile abandoned home orchard.

Thus the springing up of a tree, a bush, a bramble, a vine or a plant the fruit of which embraces some distinctive quality which attracts and holds attention, has the power to lead the careless owner back to Nature; to return a younger generation to the interests, delights, enthusiasm and ambitions of its progenitors.

HILL-TOP GARDENING.

Aside from the new fruits found growing and flourishing in Richland county, there was observed both in 1907 and 1908 another horticultural feature which was interesting to an unusual degree. The writer has referred, in one of the initial chapters, to the fact that while in Ohio there are found great areas excellently adapted to the production of special crops, there are at the same time smaller, widely distributed areas, throughout the state, where the same crops can be grown in great excellence for home use and local market. So far as vegetable production is concerned the gardens of a leading horticulturist near Mansfield are representative, in a measure, of still another class which is producing certain crops (at a profit too) under conditions generally regarded as decidedly unfavorable for such crops. I refer especially to the growing of celery by this gardener, for which he enjoys an enviable reputation.

This place is located in the southern suburbs of Mansfield, on one of the hill-tops overlooking the main or business portion of the city. While the location is an ideal one for tree and small fruits, because of its high elevation and immunity from frosts in late spring and early autumn, vegetable growing, especially in a dry season is attended by some difficulties not fully realized by the valley gardeners.

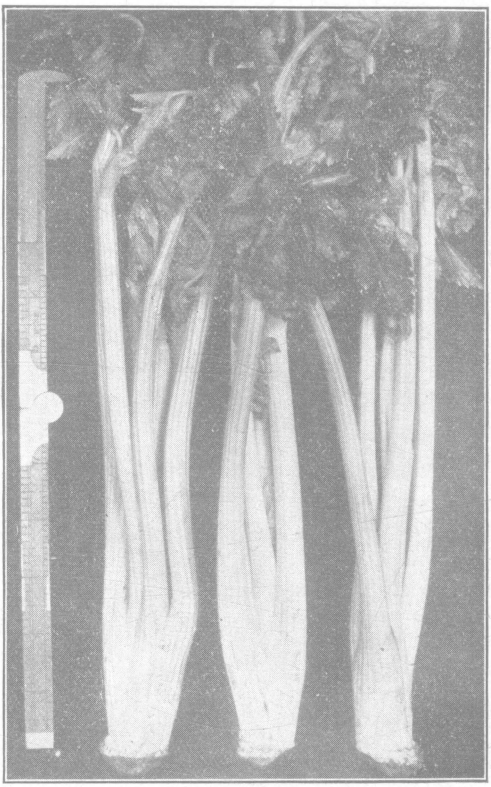


Fig. 15. Upland grown celery.

The truth that this man is accomplishing some unusual results on his hill-top soil promptly suggested itself the first time the writer was privileged to take a meal in this hospitable home. A great dish of tempting celery occupied a prominent place on the table. The individual stalks were slender and delicate—very different from the coarse, stringy product of some of the low, moist or peat soils. The quality was found to be superb. The stalks were tender, crisp, fine in texture and most delicately flavored. Inquiry brought out the interesting fact that the peculiarly fine quality of this upland-grown

celery rendered it difficult to produce any where near enough to meet the demand of the local market upon which such produce is retailed over the private bench. Stalk for stalk it would outsell the larger, coarser types from the moist, low lands; therefore, the lesser bulk did not represent a proportionate financial loss by any means.

The appreciation of this feature of gardening under unusual conditions, was taken to heart and carried home with the writer in 1907, and often commented upon when the subject of celery was under discussion. In 1908, during the second visit, I was careful to purchase a generous lot of this particular quality of celery to carry home. A season of enjoyment followed at the close of which a general discussion of "hill-top" celery would terminate only in a prevailing wish that occasions might frequently return when, while waiting on trains in Mansfield, a certain market bench might be again visited.

The lesson which we particularly desire to bring out in this chapter is that there should be an earnest effort put forth to determine if we as home and land-owners do not, after all, in our supposed unfavorable surroundings and conditions, possess some peculiar requisite to success in one or more lines of work or the growing of one or more kinds of produce, that will well repay us for our outlay of time, energy and capital.

This gardener does not necessarily have to grow celery. Other kinds of produce can be grown more easily; but the very difficulty which he meets in celery growing gives to his product a quality all its own—one which represents the difference between profit and loss and one which renders it eagerly sought by discriminating buyers.

POTATO GROWING IN THE HURON VALLEY

On August 13, 1908, a visit of inspection was made by the writer, to the lower valley of the Huron River, Erie county, for the purpose of observing conditions under which potato culture is becoming an industry of considerable importance.

Nature has accomplished a marvellous work in preparing this valley for occupation and cultivation by man. It is bordered on the east and south-east by the great eminence of Berlin Heights upon whose rugged slopes are to be seen unmistakable evidences that this was, in the glacial period, a region of wonderful activity—of terrific impact—where rock of Gibraltic resistance paralleled accessible and inviting thoroughfares for the merciless, grinding mass of snow, ice, earth and granite. Such an avenue for the onward,

southern progress of the Arctic conglomeration was the depression which is now the valley of the Huron. Levelled by the advancing bulk; thickly veneered with drift clay from the receding, melting mass; covered with sand and loam through later iceberg agency and erosion of rock and earth; for ages beneath the fresh waters of the great lake which, following the glacial period, covered much of the land now embraced in the northern part of our state, the present basin of the lower Huron is supporting thousands of beautiful homes and feeding other thousands of citizens of our own and other states, with varied products of the soil.

The soil of the valley is, as before stated, for the most part, a fertile sand, deep, dark and underlaid by a stratum or sub-soil of clay. It is therefore porous and retentive of moisture, yet readily cultivable in a surprisingly short time after heavy rainfall. These conditions favor, in the highest possible degree, the use of labor- and time-saving implements for breaking, preparing and cultivating the ground, as well as for planting and harvesting the potato crop. The cost of production is thereby reduced to the minimum. Fields of from 10 to 25 acres were observed which were clean of weeds and in an ideal state of cultivation, in which no hand work whatever had been done. The land being level, there is no loss of soil or fertility by washing during heavy rains.

Two hundred bushels of potatoes per acre, it was stated to the writer, can be averaged on considerable areas of the better soil of this valley in ordinary farm rotation of crops and without special fertilization. Indeed it seems to be a question in the minds of some of the larger growers whether the results of the application of commercial fertilizers will justify the cash outlay. Barnyard manure is, of course, used by those to whom it is available, and with good and lasting results.

So far, however, but little in the way of systematic experiment has been attempted, in this section, to test the results of using the separate or combined, commercial elements of fertility. A certain grower near Berlin Heights is planning to extend his fertilizer work and to take up variety testing under the supervision of the Experiment Station. This young man is somewhat skeptical as to the advisability of drilling in expensive applications of commercial fertilizer over the entire area of the ground, under his conditions, where, on naturally fertile soil both clover and barnyard manure are used in the farm rotation. He insists that if a small quantity of high grade fertilizer be used directly in the row, beneath the seed pieces, as applied by the leading potato-planting machines with fertilizer attachment, the results will be equally good. He

considers that, with this bit of readily soluble plant food right at hand and quickly available to the young plant, no other special fertilization will be needed; for his soil is already well supplied with every element necessary to the development of a heavy yield; and that this well distributed store of food is entirely sufficient for the demands of the plants so soon as the rootlets reach out after it. This question will probably become a problem for solution on this particular character of soil in the future.

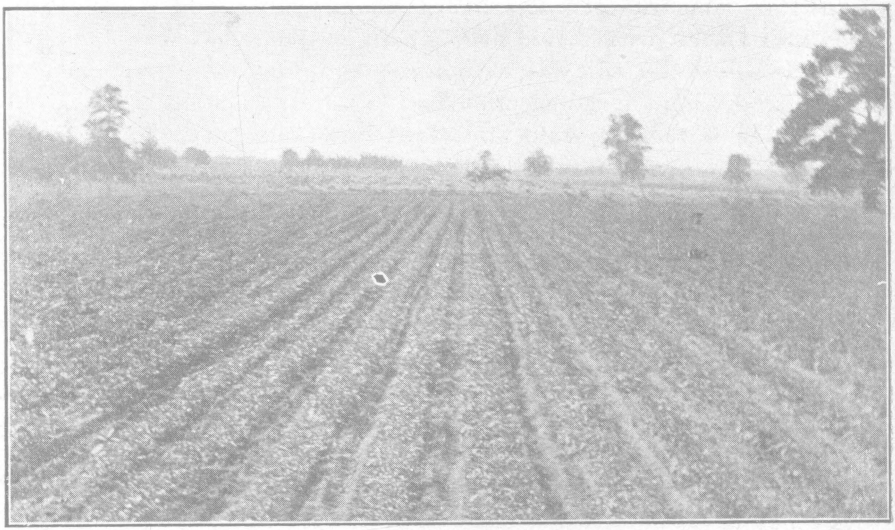


Fig. 16. A Huron Valley potato field

But few early potatoes are at present grown in the valley of the Huron. Those who have the hardihood to attempt the role of "the early bird" are said to be the *victims* rather than the *captors* of the *worm*. This seemingly discouraging feature is not, however, one that is especially peculiar to the locality. There is only one reason urged why the Huron valley does not produce early potatoes equally as well as the more noted early potato sections of Ohio. This reason, the Huron potato farmer will tell you, "is because the Colorado beetles almost invariably destroy the early-planted potatoes!" In support of this statement the writer readily admits that he observed a field of probably ten acres in which nothing was left but bare stems. Not a bushel-basket of foliage, I dare say, could have been gathered from the entire area. The simple reason for this beetleistic supremacy over man is that the man has so far shown no disposition to vigorously contest the right of the beetles to destroy his crop. No spraying has so far been done except in a small way where potatoes for early use in the home, are grown.

This apparent indifference to the serious consequences of unrestricted insect infestation can be explained by the fact that if planting be deferred until late in the season there is practically no injury to the crop by beetles. Just why this should be true in this particular locality more than in other parts of the state, I am at a loss to understand. In the central portion of Ohio, in the season of 1908, a most serious and persistent infestation by Colorado beetles occurred in August on the late planted potatoes, necessitating a battle royal with sprayer and strong arsenical poisons, to clear the plantations.

The laxity of effort in insect control, in the Huron valley, in itself serves to emphasize the statement that in this section the potato is considered to be so much at home that no radical measures need be adopted to bring it to perfection. If failure result through insect infestation or fungous disease the loss is more likely to be attributed to abnormal conditions rather than to lack of effort on the part of the planter to combat such troubles. The truth remains that the loss of income to the growers in this section, through the disposition to permit the Colorado beetle to dictate which class of potatoes shall be grown and the season at which they shall be planted, is a loss which by no means need be accepted as an inevitable heritage of the Huron potato grower. A short, sharp skirmish with a good four-row sprayer as an engine of destruction, at the critical period, viz., just as the larvae are hatching out, would mean the finish of the beetles and a generous yield of potatoes for the early market.

The menace of early blight (and this should not be confused with "tip-burn" or sunscald of the foliage—a curling of the leaves from the margins) is another hindering factor in early potato growing in the Huron basin. The later planting, it is stated, enables the grower to escape, in a great measure, the consequence of fungus invasion which is invited by the would be grower for the early market. No attempt at control of early blight, by spraying, has been attempted, although by addition of a fungicide to the spray used for beetles both troubles could be combatted simultaneously.

In the mention of these matters no criticism is intentional. The Huron potato growers, by their present policy, are succeeding in evading the common perplexities of potato farmers in many other sections of the state and are securing profitable crops of good, solid, late keeping potatoes which bring them excellent returns for their labor. But if these returns can be still further increased in any degree by suggestion of different plans to be adopted in

certain cases, or when, as is quite possible, these same growers may be confronted with the difficulties common to growers in other parts of the state, the good intentions of the writer shall have borne the desired fruit.

The main crop, in this section, is planted about the 15th of June. This late planting is supposed to be practically immune from the attacks of beetles and generally secure from danger of late blight. No spraying whatever is calculated to be done in bringing to perfection this late planting. Even the leading potato farmers have not yet considered the purchase of spraying machinery justifiable—though there has, at times, been some loss from late blight. The present season, however, was, in August, still supporting the non-spraying grower in his argument that spraying is not necessary. Great areas of late planted potatoes were the living pictures of health and thrift—the vines covering the ground at the date of the visit. Not a beetle nor a blighted leaf were in sight.

It is evident, we will freely admit, that a field of perfectly healthy and insect-free potato vines cannot be much improved by spraying; but the time must surely come when great loss shall be suffered through over confidence in the "special immunity" of this so far favored section to the obstacles encountered in potato production by growers in various other districts of the state.

The splendid size, uniformity and smoothness of the potatoes grown in the Huron valley sand, insure a ready market at top prices among buyers, while excellent shipping facilities render this section within close touch of the markets of Cleveland, Toledo, Chicago and other large cities.

Notwithstanding the present-day success in the growing industry of potato farming in the Huron valley, there are yet better things in store for the wide-awake growers in this section. As before intimated, losses may have to be sustained, however, before certain means of improvement and insurance of success will be accorded general recognition. In addition to a change of attitude toward spraying for insects and fungi, which must surely come in the future, there will naturally develop an interest in the improvement of seed stock and in varieties of potatoes, which is now but little in evidence. The demand of the day, in this section, is a potato that is round and white. The type represented by Sir Walter Raleigh, Rural New Yorker and Carman No. 3 is the type most liked and generally grown. It seems to matter little in this section which of these three varieties is the stock in hand. Consequently there is a general mixture of these varieties in the same stock. It is stated

too, upon good authority, that an eastern seed firm has offered a slight advance over the market price for this generally composite stock of the Huron valley potatoes, which no doubt would be reshipped to planters as pure seed stock of either Carman, Rural or Sir Walter Raleigh. This failure to recognize a distinction between varieties of the same type can only result in ultimate embarrassment and a loss to both grower and dealer.

The growing of high-class seed potatoes, upon the other hand, promises a lucrative field for the Huron valley grower. His soil conditions produce tubers of beautiful form and fair skin. The introduction of our excellent newer varieties in this section, or of seed of undoubted purity in the older sorts, together with careful seed selection and improvement would, without doubt, increase the average yield per acre very materially. Arrangements are being made which will present to the potato growers of this valley an opportunity to observe and study many of our excellent and promising newer varieties as well as the standard kinds on their own character of soil and under their particular conditions.

So far as the writer is able to judge, there is not a section in Ohio which is more excellently adapted to potato growing than the one here described; and no reasonable effort should be spared either by the grower so favorably situated nor by those interested and engaged in experimental and investigational work, to bring about a system of cooperation which will tend to develop the possibilities of this unique river basin of a county which produced over 333,300 bushels of potatoes in 1907.

A POTATO GROWERS' MEETING

A visit was made by the writer to the valley of the Sandusky river where potato growing, as a business is attaining quite a degree of importance. It was arranged that the potato growers, farmers, horticulturists and all who were interested in the tilling of the soil, should, under the auspices of the Ohio State Horticultural Society, be invited to join in this visit of inspection. It was anticipated that the topographical and physical conditions which so favor potato culture in this part of the state, would be interestedly observed by the visitors. Moreover, it was deemed of consequence that there should be afforded to the public a comprehensive demonstration and exhibit of those features of potato growing that are at present the subjects of study by scientists as well as leading plant breeders and practical growers everywhere.

These object-lessons covered the fields of potato varieties, variety testing, potato seed selection and improvement, soil fertilization experiments in potato culture and modern methods and equipment for harvesting the potato crop.

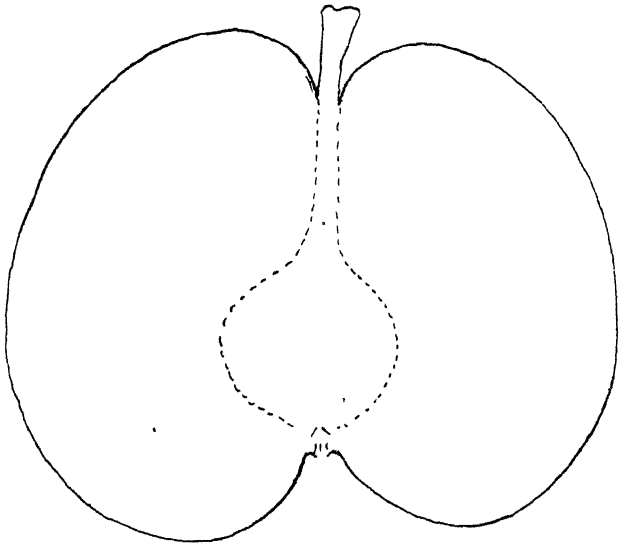
The meeting was held near Tiffin, Seneca county. It was an interested, enthusiastic convention of Ohio's tillers of the soil; these including not a few persons from the cities of Tiffin, Fremont, Cleveland and Toledo. Fully five hundred people were present. The proprietor at whose farm the meeting was held is pursuing the lines of corn and potato breeding and experiments in fertilization of these crops, as well as the growing of alfalfa. There were on exhibition at this meeting an extensive collection of "hill-row" products of potatoes from hill selection work; also the various products from different quantities and combinations of fertilizers. The different lots were all shown in crates with explanatory labels.

Fig. 17. Potato digging demomstration at Tiffin, Ohio.

An especially attractive feature was a field demonstration with different potato diggers; this interesting exhibit was given by various manufacturing firms which build potato digging machinery. Five firms were represented in this demonstration which was not in any sense of the word, a contest. No premiums were offered nor was any committee nor individual appointed to determine which of the machines did best work. All worked well under the favorable soil conditions existing at that time, and the great company of visitors which followed the diggers to and fro across the broad potato field, was allowed to draw its own conclusions.

A program had been prepared and was rendered dealing with varieties of potatoes which had been tested on this farm (some 20 varieties), with potato seed selection and improvement and with the culture of alfalfa. The visiting potato growers and farmers

took an active part in the discussion of the subjects presented, and many points were brought out that will prove helpful in the future work of growers. The farm at which this meeting was held is located, as before stated, in the valley of the Sandusky river which flows north through Wyandot, Seneca and Sandusky counties. Soil conditions in this part of the valley are not dissimilar to those existing in the lower valley of the Huron river, some 30 miles north-east, which will be found quite fully described in a preceding chapter.



Fig, 18. An excellent type of Sheldon pear

A TYPICAL ORCHARD PROBLEM

During the Ohio State Fair of 1908 a resident of Licking county, left specimens of pears at the Experiment Station's exhibit, for identification. The pears were said to have been grown upon a tree which came up, as a sprout, from the stump of an old tree long dead and gone. As the specimens were of peculiar and distinct "apple shape" and not ripe enough to judge as to their quality at that time, the matter was referred by Prof. W. J. Green, Horticulturist, to the writer, with instructions to visit the grower and endeavor to determine whether the tree were an offshoot from the original variety or from the unknown, seedling root.

Accordingly the designated place was visited a few days later. A careful examination was made of the vigorous, upright, young tree which was found to be five or six inches in diameter of trunk at one foot above the ground, and perhaps sixteen feet in height.

It was difficult to determine whether it sprang from above or below the point at which the original union between bud and stock had been effected, as the stump of the original tree was almost completely rotted away. A comparison of twig growths of the bearing tree with younger and very thorny shoots emanating directly from diverging roots indicated, however, that the bearing tree undoubtedly represented the original variety as had a previous young tree the stump of which is still standing and shown in the photograph of the base of the young tree. The former young tree evidently had never borne, or else its first fruits had failed to attract the attention of the owners, as it clearly had been the victim of a dull axe in the hands of a careless chopper.

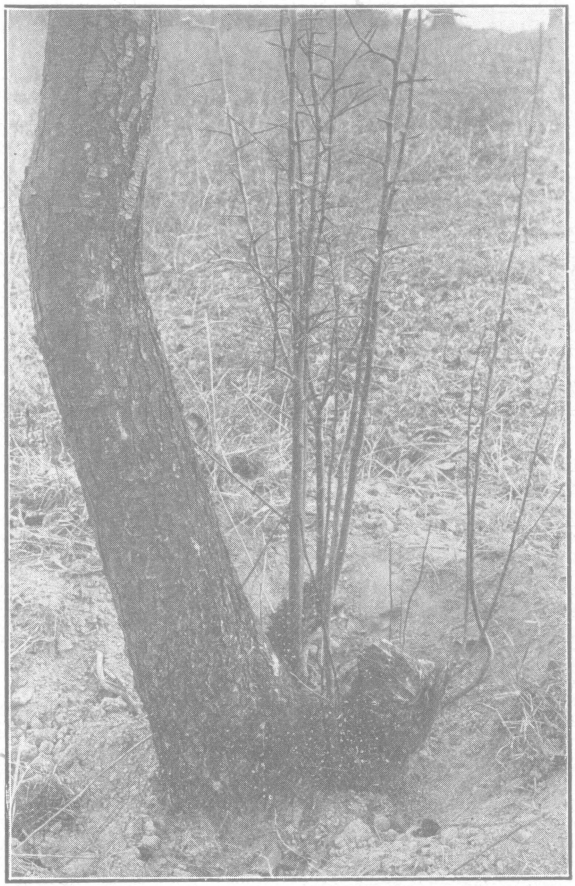


Fig. 19. Seedling or original—which?

The owner had, in his enthusiasm over this "new fruit," entertained the thought and hope that it might be a seedling. There seemed not to be sufficient evidence to warrant such a conclusion. If it were an old variety, however it had assumed an exterior guise in which neither Prof. Green nor the writer recognized it. It was almost as truly an apple form, or oblate, as is the Japanese Golden Russet pear. Especially did the larger specimens adhere closely to this form. The lesser fruits approached in some degree a short pyriform or pear shape. In this uncertainty the medium size, typical specimen shown in the accompanying sectional drawing was forwarded to Prof. G. B. Brackett, of the Bureau of Plant Industry, Washington, D. C., who later pronounced the variety a fine type of Sheldon.

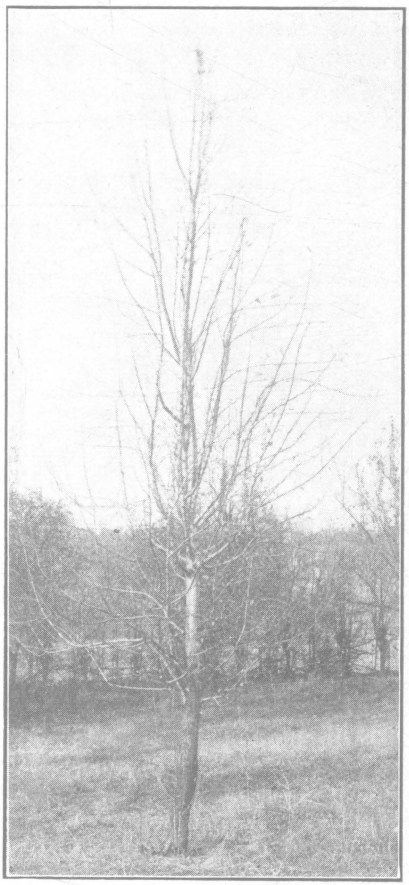


Fig. 20. Tree whose base is shown in Fig. 19.

This highest authority in our land should be convincing and conclusive. Otherwise than the peculiar and marked apple shape this pear possesses the characteristics of Sheldon. Its quality, judging from specimens which the grower had saved until the time of my visit, was of that excellence for which the Sheldon is renowned. Yet among the considerable number of plates of Sheldons which the writer has handled in connection with exhibition work in Ohio, not a single plate of this distinctive apple form of Sheldon has been observed. All have approached, in some degree, a short pyriform.

This tree will be kept under observation in the future and specimens of fruit secured to compare with Ohio grown Sheldons from other sections of the state.

In addition to this special pear problem—the springing up of a young tree in an old neglected and well nigh abandoned orchard is representative of a vast number of old orchards and serves in excellent illustration of points which have already been brought out in preceding chapters of this Inspection Report.

TWO NEW SEEDLING APPLES OF MERIT

1. THE LINVILLE

This variety originated as a chance seedling near the village of Linville which is situated on the old National Road in southern Licking county. The tree stands in the edge of a pasture field where, for many years, it was subject to the injuries, mutilations and various "set-backs" incident to such a location. The tree is now quite large, spreading and vigorous.

No special attention was given the tree nor its fruit for a number of years after it attained the bearing age. Insect pests and fungus disease prevalent in many scattered, neglected orchards of that section, were responsible for the annual dropping or gnarling of the fruit. However, late in autumn, six or seven years since, after a series of frosts had stripped the tree of its leaves, quite a number of beautifully colored apples attracted the attention of the owner. Late one evening, as snow was beginning to fall and cold to threaten, he shook the fruit from the tree and carried it to the dwelling cellar. Many specimens were sound and perfect and hard. They kept well and in late winter were found to possess a very pleasant flavor. The attention of the writer was called to the apple at that time. Specimens were secured and shown at the 1902 State Horticultural Meeting at Clyde. It was there reported upon by the Committee on Awards as follows:

"Your committee have to report a seedling apple under the name of "Linville" which appears to be an apple of good quality as a winter fruit—firm and of good flavor and color. Dessert or cooking apple."

The following spring a visit was made to Linville and scions procured. From these a number of root-grafts were made to produce new trees and the balance top-worked upon two trees in the home orchard. As a result the season of 1908 finds several young trees growing vigorously and the larger one of the two trees grafted over entirely to this variety bearing a fair crop of Linvilles despite the fact that a heavy snow came when the tree was just coming into full, heavy bloom, remaining upon the blossoms and branches for 36 hours or more, followed by many days of cloudy, cold, wet weather.

The bearing of these grafts has renewed an interest in this really promising variety which was declared in 1902 by the Pomologist at Washington to resemble Nero—an apple not widely known in the central states.

DESCRIPTION:

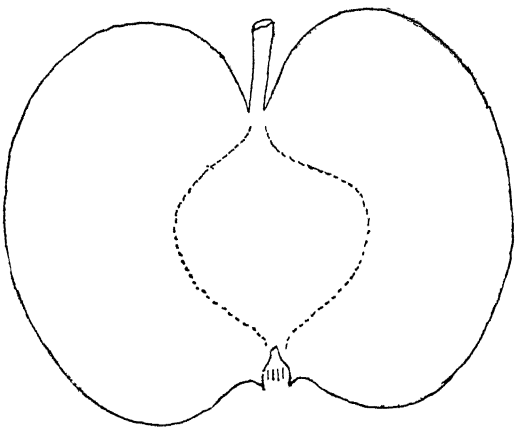


Fig. 21. Linville

Medium in size, roundish-oblate, quite uniform in both size and shape; surface yellow or greenish-yellow almost wholly covered with rich, dark red except about the basin where the lighter under-color is exposed; dots few, light grey or russet on the darker specimens, yellowish on the lighter ones; cavity medium in breadth and depth, usually regular, with russet radiating from within; stem short and strong; basin rather wide and deep, usually smooth but sometimes slightly corrugated; calyx closed or slightly open. Flesh yellowish, firm, crisp, juicy, sub-acid, pleasant, refreshing. Season, December to March.

2. DALE VIEW DESSERT

This variety originated as an accidental seedling in an old chestnut grove on a farm in south-eastern Licking county. Little thought was given either to the tree or fruit other than to gather in the fall, for late autumn and early winter use, such crops as the insects and fungi permitted to develop.

Six years ago the writer visited the farm and discovered the excellence of the quality of this apple from a few specimens which had been overlooked by the tenant at the time of gathering them. A number of the apples were taken home and their culinary qualities tested. They were found to be excellent for sauce, pies, etc., rich and fine in flavor, cooking yellow as gold.

Scions were taken the following spring and a tree in the home orchard grafted over entirely to this fine sort. As with the Linville, these grafts bore in the season of 1908, reacquainting us with the qualities so much admired at the time of discovery.

This variety belongs to the American Golden Russet or Bullock Pippin type, but bears many specimens of a size rarely attained by that delicate little apple. Its size is quite variable, however. The skin is thicker and the russet markings heavier than on the American Golden Russet.

DESCRIPTION:

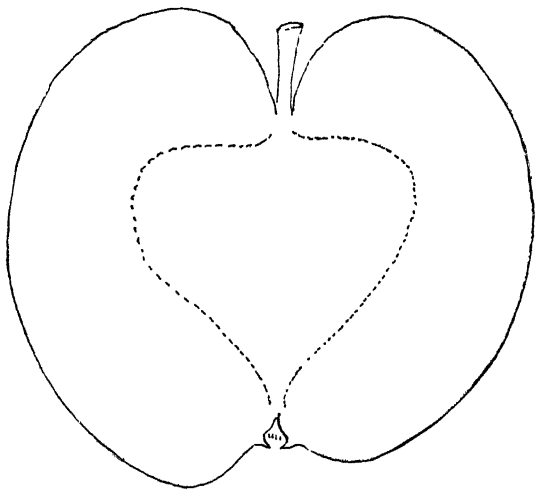


Fig. 22. Dale View Dessert

Because of its superb quality both for eating out of hand and for cooking, the grafted tree of this variety was labelled "Dale View Dessert"—a name which there seems no good reason to change.

Medium or below, in average size, though some specimens attain the diameter and length of two and one-half to two and three-quarters inches; roundish or oblong-conical, one side sometimes a little heavier than the other; surface yellow flecked and patched with russet—the yellow predominating; sunny side often blushed with dull, brownish red in faint dottings and splashes; dots numerous, large, russet; cavity small and regular; stem short and slender; basin very small, regular; calyx small and tightly closed. Flesh yellow, juicy, sub-acid, sprightly, rich and good. Tree a rather slender but vigorous, upright grower.

Desirable for home use, but probably not sufficiently attractive in color for market.

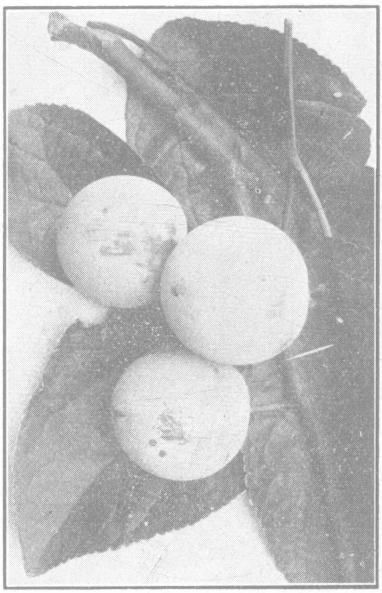


FIG. 23. A New Seedling Plum

TWO NEW SEEDLING PLUMS

1. A seedling plum of most excellent quality was found near Mansfield, Richland county. In fruit it is distinctly of the Reine Claude type, being large, roundish, with a short, thick, strong stem; color, greenish yellow with marblings of a deeper green, over spread with a thin, white bloom. The flesh is very firm though juicy and excellent, separating freely from the small, oval pit. Season September 15. The tree is a strong, spreading, rugged grower and prolific. A very excellent plum for home use. Its color would be somewhat against it for market.

2. There was exhibited at the Ohio State Fair, 1908, a new plum which originated as a seedling on a fruit farm in Ottawa county. In order that its culinary quality might be tested, the writer was presented with a small basket of the fruit at the Fair. As a variety for stewing or canning it would be hard to surpass in all the list of European plums. It is a matter of regret that a photograph cannot here be given; but the many duties of the writer, during the Fair, prevented the picture being secured. The tree was seen during the summer of 1908, but after the fruit had been gathered. It is a strong, vigorous, spreading grower.

Fruit is medium in size, round, blue and covered with a light bloom. Flesh firm, sweet, rich and good. This promising seedling plum has been named "Gill."

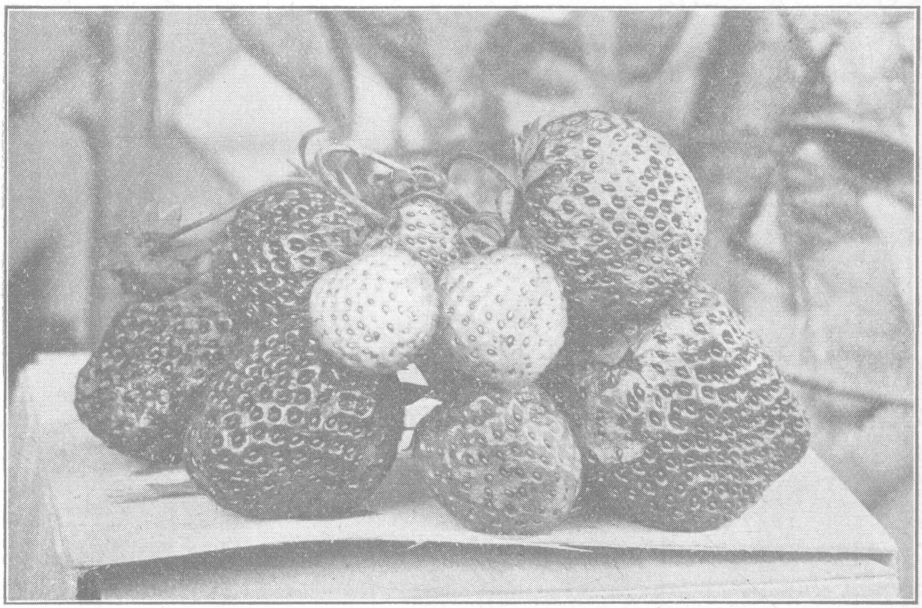


Fig. 24. Fae.

THREE NEW SEEDLING STAWBERRIES IN FAIRFIELD COUNTY

In the Spring of 1908, a stawberry grower of Fairfield county, Ohio, sent to the Experiment Station, for trial, three new varieties of strawberries, originating as seedlings on his farm. These were sent under the names of Fae, Mollie and Buster Brown. In June of the same season the originator requested that a representative of the Horticultural Department of the Station visit him and see his new berries fruiting. In response the writer proceeded to his place in June. I am pleased to submit my report as follows:

All varieties of strawberries were, at the time of my visit, suffering from dry weather, though on this place where the soil is of a clayey character conditions were much more satisfactory than where the soil was of a sandy or gravelly nature, as in other sections where observations had been made. A good picking of handsome berries was in progress on the day of my visit. A number of our standard sorts were being harvested. Our friend had been holding on the plants for several days the ripe fruit of his new berries in anticipation of our visit, in order that a fair estimate of their prolificacy might be obtained. Some of the first fruit to ripen, therefore, was in a slightly over-ripe condition, though the percentage that was unfit for market or use at home was very small. Taking up the new varieties in the order of their apparent merit the descriptions are given below:

Fae. Imperfect blossom. Berries large to very large; usually conical, though some specimens are slightly flattened, wedge-shape or divided; color crimson, bright, somewhat glossy, attractive. Flesh pink, firm enough to carry well and of pleasant flavor.

Plants unusually healthy, forming fine, broad, fruiting-rows; very prolific on its home soil. From the fifty foot section of row fruiting, the rate of 2900 quarts per acre, for the single picking, were taken off on the day of the visit. It must not be forgotten, however, that this first picking had been delayed for some days in order that the whole amount of fruit the plants were carrying might be seen. But side by side with the Haverland the Fae is carrying almost as many berries in number and double the size of this well known sort. The trusses are large and support as many as ten berries each in some instances—all well formed this season. The Fae is mid-season in ripening.

This variety was named in honor of the originator's little daughter who takes great interest in her father's business and does the clerical work and much of the crating of berries in the conveniently arranged packing house.

Mollie. Imperfect blossoms. Berries medium to large, conical sometimes a little flattened though usually of uniform shape; bright crimson in color. Flesh is pink, firm and of fair quality.

Plants are quite vigorous, free from disease and moderately prolific. Compared with Nettie the season of Mollie is fully as late at this farm, and it seems superior in vigor of plant; its color is much better and it is fully as firm if not more so.

This variety was named for a young lady who, for several seasons, has been a valued strawberry picker in the originator's plantations.

Buster Brown. Perfect flowered. Berries large to very large, long conical, flattened, furrowed or ridged, sometimes coxcombed; color very dark crimson when fully mature. Flesh rich red throughout, moderately firm and of good quality.

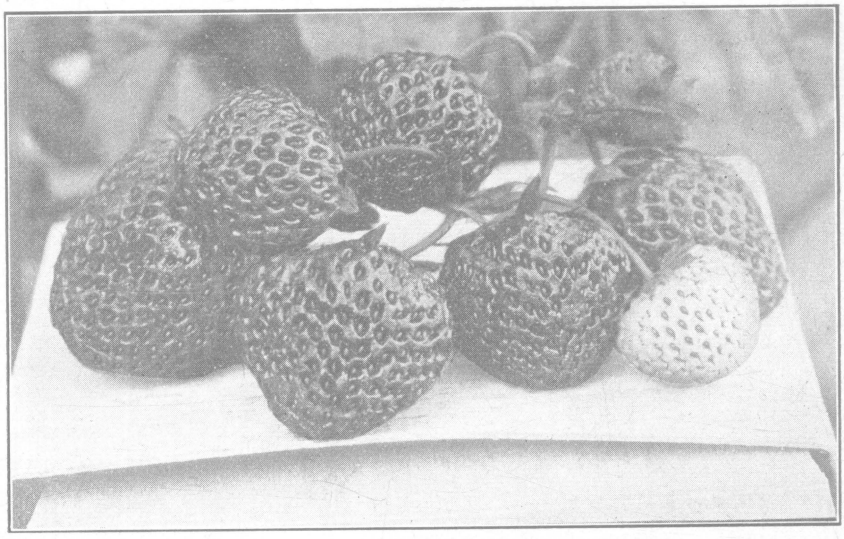


Fig. 25. Mollie

Plants are individually very large and strong in habit, though they show much more leaf-blight or rust than Fae or Mollie; plants send out but few runners, hence it is a rather scant plant maker. Ripens its crop in mid-season.

While named in honor of a very popular character this variety is not so promising as Fae and Mollie, though it is certainly a large and handsome berry. Specimens carried home for photographing were too far gone for securing creditable pictures.

Brief mention of the section of the state in which this grower's farm is situated will not be out of place.

It is situated about 25 miles a little south of east of Columbus and about 10 miles due north of Lancaster. It is the shipping center of an area in which the production of small fruits—especially strawberries—is an industry of considerable importance. Topographically this section is an elevated, comparatively level plain or table land near the head-waters of the south branch of the Licking river, flowing north, and the Hocking river, flowing south.

The farm visited lies about one-half mile north of the village. The soil is, for the most part, a heavy clay loam which seems peculiarly adapted to strawberry production. It is to be presumed

that the conditions observed are rather typical of those prevailing throughout the section surrounding Baltimore for there are several large and successful strawberry growers who are shipping out fruit from that station.

There is apparently much interest taken in the testing of new varieties of strawberries in this neighborhood, though no careful attempts at scientific breeding have been made locally. Under the circumstances this is somewhat surprising; for while the standard sorts seem, with few exceptions, to be succeeding as well or better here than in many other places in the state, there is being conducted a vigorous and, incidentally, expensive search for something of still greater value. I believe that the time is near at hand when some of the more studious growers will elect to take up the work of mating the standard varieties with a view to combining, in separate new varieties, the more valuable and desirable characteristics of two or more old kinds which now succeed best on their particular soils. I am impressed that a bit of definite instruction and a few helpful suggestions along the line of strawberry breeding would in this section, as in many others, be gratefully received and would justify the Horticultural Department of our Station in preparing and issuing, in brief form, just such a treatise. The objection might be urged that this would accelerate the multiplication of an already too extensive list of varieties; but it must be remembered that the unabating interest in and desire to test something new stimulates the multiplication of new sorts in other sections if not at home. If some of this work could be scientifically done individually or in one's home section the desire to test new things would be satisfied and the results would, no doubt, be more gratifying and the expense much less. It is folly to entertain the notion that some other county, some other state or some remote section of the country is more likely to produce new fruits superior to that which may be perfected at home. It is a well known fact—especially to those who have made a study of new varieties of strawberries in Ohio—that new sorts which come to us from the eastern and New England states, or those which come from the far west or southwest, to say nothing of those which come from the south, rarely bestow upon us a variety that becomes standard because of its merits. Among the more excellent of the newer varieties of today those which originated right here in Ohio are succeeding best under Ohio conditions. The same truth will prevail as regards varieties produced or improved in our own county, our own neighborhood or upon our own soil.

The grower visited in Fairfield county, grows seedling strawberries from the seeds of select berries of different varieties. This is certainly a long step in advance of the too common endeavor to find, among accidental seedlings springing up in out of-the-way nooks about the farm, something of value; but the interest and the results should be far more gratifying if the parentage on both sides were a matter of control and record, as in careful isolation of the parent stock and hand pollination of the blossoms.

A SUBJECT OF MODERN INTEREST.

Variation in plants as affecting the improvement or degeneration of varieties.

The basic principle upon which the modern plant breeder rests his reasonable hope of improvement of varieties is the natural variation of plants, not only within the same family or species, but within the same variety. To many of us it is yet a surprising proposition that there are no two things in nature exactly alike. While this is true, we are prepared to believe it only in part. We are ready to admit that there never have yet been two human faces, forms nor dispositions absolutely identical; that there have never been two animals of the same kind bearing physical likeness in every particular, intelligence in the same degree nor dispositions of indistinguishable character. But that plants, even of the same variety, possess individuality and differ one from another we have never, perhaps, been led to consider.

But let us, for the purpose in view in this introduction, hasten to recognize this fundamental truth: there are not only no two trees nor plants of the same variety exactly alike, but no two branches of the same tree, twigs of the same branch nor divisions of the same plant identical in form or character. Even the different buds of the various branches, divisions or twigs possess individuality. These differences are, for the most part, so very slight, so generally imperceptible to the casual observer, that we are warranted in designating a carefully perpetuated variety as pure and practically true to type. However, these variations have no set boundary—no restricted range. Just as an occasional individual person of the same race or family will physically, mentally or morally advance beyond or fall below the average of his people, so do individual trees and plants, or certain branches or buds of individual trees and plants, exhibit points of marked excellence or inferiority to the average of their kind. These lesser variations, in the plant world, we designate "bud variation."

Through the medium of bud variation, therefore, may a variety be improved or permitted to degenerate. It may be improved by the exercise of proper care in the selection of those occasional individuals exhibiting definite points of excellence and the increase

of these by the usual means of propagation of the species. Upon the other hand, a variety may degenerate through failure to exercise reasonable care in selection for propagation and planting, the superior types, or by rejection of the inferior types as they from time to time appear through bud variation.

In rare instances an individual tree or plant will vary or depart so widely from the common type of the variety to which it belongs —in habit of growth or in the character of its product—as to justify its being regarded as a distinct type or, indeed, a new variety. Such a departure from the parent type, scientifically known as mutation, is commonly and, indeed, appropriately, termed a "bud sport" or "bud freak;" for it must be borne in mind that a tree, branch or twig, or a plant grown from a division of stalk, root or tuber, which exhibits this marked unlikeness to the original form, had its origin in an individual bud.

It is gratifying to note that, in Ohio, these facts relating to the individuality in plants are being widely recognized by both the agricultural and horticultural classes of soil culturists. Substantial progress is being made in certain lines of plant breeding by selection; especially is this true with corn and potatoes.

It is not the purpose to take up the discussion of the various definite lines of plant breeding work in progress in Ohio, at this time; but to stimulate, by a few examples personally noted, a still wider interest in and observation of the variations of plants, by the nature-loving citizens of our state. The man, woman, boy or girl in whom is aroused the disposition to closely and studiously observe that which may be seen all about them—in field, coppice, forest and along the roadsides as well as in orchard and garden, naturally becomes a life member of the rapidly growing nature-student body which is already making its influence felt in the discovery, selection and improvement of those plants which in part feed us, and which beautify our homes.

The following chapter beautifully and fitly illustrates the wonderful phenomena of plant variation to which reference is made in this. Other examples will also be given, which have come under the personal observation of the writer.

A NEW TYPE OF CONCORD GRAPE.

In the autumn of 1906 the writer was apprised of a phenomenon in the form of an unusually large Concord grape which had appeared in the small, home vineyard of a leading market gardener of Richland county. In 1907 an invitation was kindly extended to come and

examine the grape which was fruiting for the third time. The invitation was accepted and the visit proved one of more than ordinary interest from a horticultural standpoint. Mental note of several features of peculiar interest was made, including the distinct and striking type of Concord grape which headed the list and in which there was no disappointment. It was resolved to keep these interesting features under observation for another season or two, or until such time as a report could be made that should prove of general interest and value.

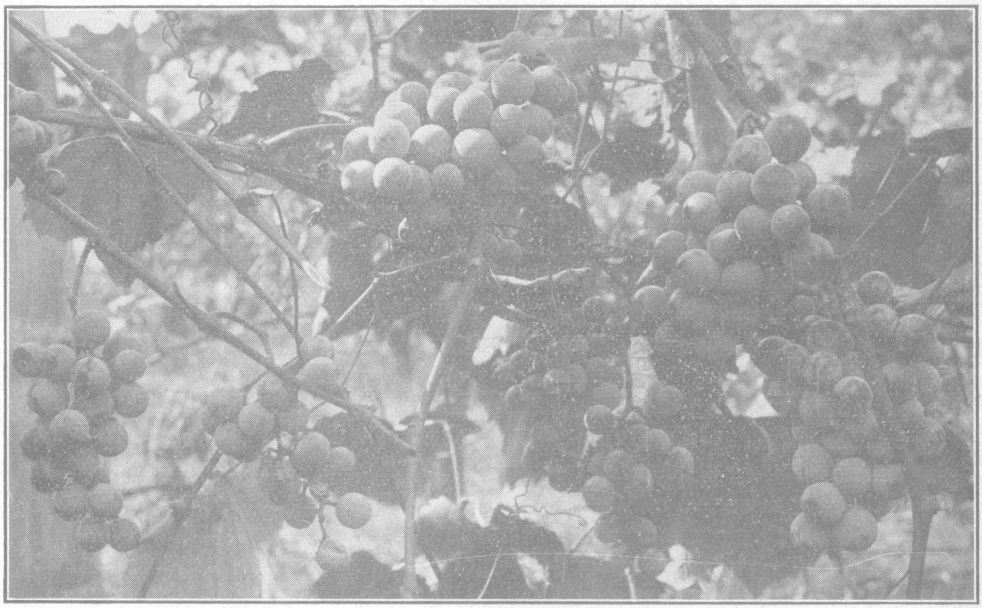


Fig. 26. A striking example of "bud variation." The new type of Concord grape as it appears growing on the parent vine.

In September of 1908, under the provision of the Division of Inspection, a second visit was made. The new type of Concord was still found true to that mysterious and wonderful law which our Creator, through the medium of nature, exercises in the perfecting of new types and forms in the plant world. It was fully up to the standard of its excellence of the preceding season—so persistent, indeed, to its novel characteristics, that it is a pleasure to record in this chapter, its bit of history, well illustrated by photographs from nature.

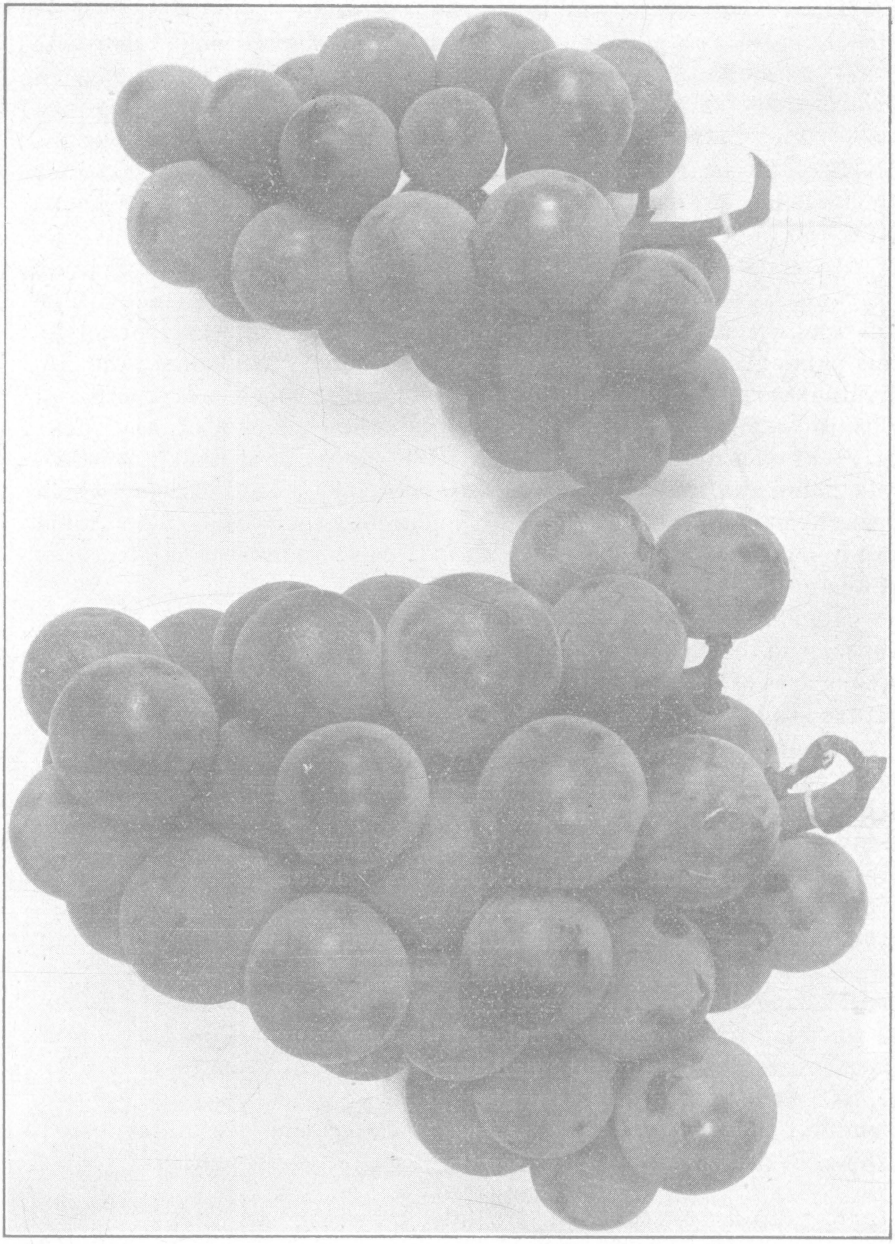


Fig. 27—"Life size" photographs of the common and the new or mammoth type of Concord grape.

The new form is clearly the result of mutation—a "bud sport" or "bud freak." The vine upon which this new type originated is one of several composing a row of Concords in the small vineyard. This particular vine producing the "sport" divides near the ground into four or five parts which were originally trained upward "fanshape" to the trellis of horizontal wires. From the various divisions the bearing shoots sprang out laterally, each season, such shoots being cut back at each annual pruning to one or two buds. Near the upper extremity of one of these divisions and fully five feet from its base, a certain bud pushed out a shoot which, in appearance, is similar to others springing from the same vine. The following season, however, the single cluster which was borne by this particular new shoot, was so large and handsome and individual berries of the cluster so abnormally large as compared with the common type of fruit borne by the balance of the vine, that it at once attracted attention. The location of the new shoot was noted and the fruit eagerly observed the second season which brought more clusters of equally mammoth berries. The third and fourth seasons, as already stated, have exhibited no features of disappointment.

The photographs show just how the new form of Concord appears on the vine in comparison with the common type borne by other parts of the vine. It was a sight to delight the heart of a nature student.

In conclusion, this new grape is simply a giant Concord. Its color, texture, quality and season of maturity are very similar if not identical. Its value, should the vine upon its own roots prove similar, (which there is no good reason to question) lies chiefly in its superior size and attractiveness. Its parent is so rugged in growth and so generally adaptable to different soils and climatic conditions, that it is reasonable to predict that the offspring would succeed over an equally wide range of country.

No vines of this new grape have yet been propagated, hence no stock is for sale. Nevertheless its owner values this gift from Nature very highly and no small sum would tempt him to part with it. It is to be hoped that a number of new vines may be grown from the new wood, next season; for, should the unexpected happen to the parent vine the new type would perish with it.

TWO ILLUSTRATIONS OF "BUD SPORTING" IN APPLES

1. A well-known fruit grower of Ross county, exhibited at the Ohio State Fair, in 1908, a type of Grimes' Golden apple which presents another excellent illustration of "bud variation." In this

example the *form* of the fruit alone is affected. Instead of the usually roundish or more frequently slightly flattened or oblate form, this type is decidedly oblong.

A plate of this interesting form of Grimes' Golden was secured, from which a typical specimen was taken, cut and photographed "life size." From this photograph the sectional tracing or drawing was made from the actual outlines of the picture, which is given herewith.

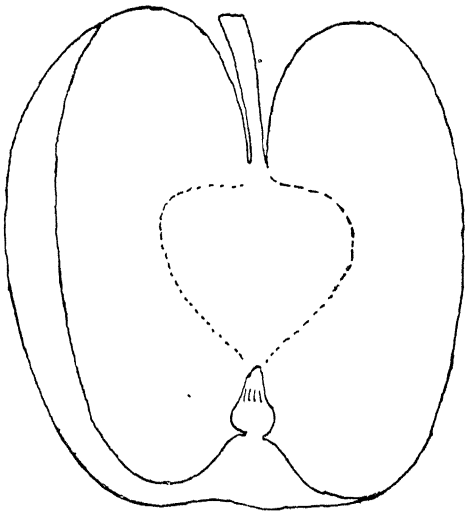


Fig. 28. A distinct type of Grimes' Golden.

This form of Grimes is, of course, no real improvement over the common type, so far as it affects its value. It merely serves to illustrate that different forms of the same variety do exist. The tree upon which this type of Grimes grows is apparently of the ordinary character, but always bears fruit of the oblong shape. The quality of this type is the same as that of the original. It is a clear case of bud variation—the well-grown tree now exhibiting the peculiar characteristics of the single tiny bud from which it was propagated—that single bud among thousands of the same variety which proved so markedly different from its fellows.

2. There was also exhibited, from Lawrence county at one of the Ohio State Horticultural Society's meetings at Columbus, in 1906, a type of Rome Beauty apple that was clearly the product of bud variation. Instead of the characteristic striping of red over the yellow "ground" or "under-color" the type exhibited possessed a smooth, solid, brilliant, rich, dark red color unbroken by stripes or splashings so familiar to those who know the common form. There

was not a single exterior feature aside from the peculiar, smooth. gradually sloping cavity so characteristic in the Rome Beauty, that would enable one to identify this new type. Even the interior of the cavity (usually green or greenish-yellow in the ordinary type of Rome Beauty) was a solid, smooth red in the new type.

It was stated that this Red Rome Beauty is produced upon a single branch of a tree which otherwise bears fruit of the common color and markings. It is evident that this branch had its origin in a single bud just as did the entire tree of Grimes described above.

It is not known by the writer whether this new type of Rome Beauty has been propagated or not. Undoubtedly it would possess extraordinary merit providing the change in type brought with it no physical nor physiological weakness so far as growth and health and fruitfulness are concerned. So far as is known, the chances are about equal for the new form resulting from bud variation, to possess a similar, a higher or a lower degree of vigor. This is a matter to be tested out in each individual case.

A STRIKING LESSON IN PLANT SELECTION

A clear-cut example of the value of selection of plants showing a peculiar resistance to disease, has been studied with renewed interest by the writer in the season of 1908. While urged to relate this experience through the horticultural press, as a contribution to the subject of plant breeding which is of such general interest at this time, it was preferred to include it, in connection with other examples of natural variation of plants, in this horticultural inspection report.

Subsequent to the introduction of the Loudon red raspberry, about a dozen years ago, there were procured 24 plants of that variety from one of the eastern nurseries. They were carefully planted in good soil with a view to rapidly multiply the number of plants for setting. At the time of planting there were noticed a few very inconspicuous "galls" or enlargements on a number of the roots and rootlets. So slight were these that they might easily have been overlooked by the packers at the nursery—even had they been conscientious in their work. The plants grew fairly well, and at the end of the second season after planting there were 300 "sucker plants" available for setting. The plants were dug the following spring and nearly all showed more or less infection by the root- or crown-gall. All were planted, however, as there was not, as yet, that familiarity with that scourge as there was destined to be later in the same season. By midsummer only five plants out of the 300 were living; these were the picture of health and vigor. In the fall these were dug from the different parts of the plot in which they were standing and set together in a short nursery row for the pur-

pose of making another trial of growing plants for a Loudon plantation. After two more seasons had passed, from these fine strong plants, there were dug nearly 500 good plants. No root-gall whatever was found although a close inspection was made of the plants as dug.

The new lot of plants was planted on an excellent piece of ground. Alongside of the Loudons were also set 800 Miller red raspberries which, though unselected for disease resistance up to this time, had proved comparatively free from root-gall. All of the Loudon plants as well as those of the Miller made a fine growth. The Loudons the following year bore a generous crop of the largest and finest red raspberries so far produced in that section. There was no evidence of root-gall or disease of any kind. Two more enormous crops were gathered in 1902 and 1903. The plantation was improving both in cane growth and yield. During the succeeding four years the Loudons continued to produce heavily, much more so than the Millers, and there was not a single break in the rows from the inroads of the dreaded root-gall. In the meantime, however, cultivation having been discontinued, the blue grass was gaining a foothold, and by the spring of 1908 the plantation was so sodded that it was decided to clear off and plow the ground. Not having forgotten the initial lesson in plant selection, it was desired to make close inspection of the old Loudon patch, to determine whether there had been any later development of root-gall. Perevious to starting the plow I took a spade and dug up sections of the Loudon rows in all parts of the plot. *Not a single evidence of root-gall was found even on the old stools which were evidently the original or parent plants of the plot.* Old and young plants alike were clean and healthy. This gratifying result led to the inspection of that part of the plot containing the Miller reds. After digging in many places throughout the area in which these were planted *not a single healthy plant could be found. Every plant uprooted showed more or less root-gall.*

As it was late in the spring of 1908, and not much space to spare, only a few of the Loudon plants were saved. This number included both old stools and younger plants. All alike have again grown vigorously and uniformly—as beautiful plants as one could wish to see. A photograph of a typical old plant, as dug from the old patch, is shown herewith.

This has been an experience of unusual interest in the study of disease resistant strains of plants. As all are aware who are at all familiar with varieties of red raspberries, the Loudon, while one of the finest varieties ever introduced, early proved to be discourag-

ingly subject to root-gall. Indeed, so generally recognized became this apparently inherent weakness of the Loudon that it has been gradually dropped from the lists of many—nearly all—plant growers. It is now a difficult matter to obtain plants of this beautiful and superior variety.

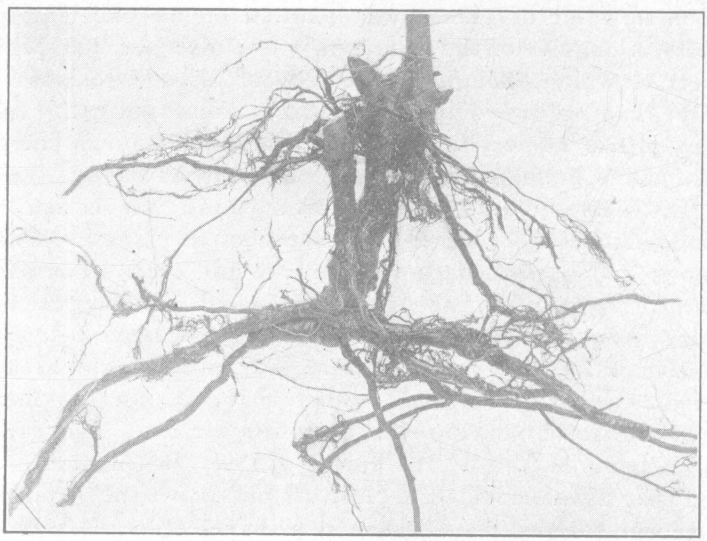


Fig. 29. An old root of disease resistant Loudon.

There are two points which the writer desires to be clearly understood in connection with the submission of this chapter:

First—There are no plants for sale or to spare, of this strain of the Loudon red raspberry improved in disease resistance through elimination of the weaker strains. Should there be plants to spare in the future it will be only after ample time shall have elapsed for any grower who desires a better strain of this variety, to secure plants from other sources and breed up, for himself, by selection of the strong and elimination of the weak, an equally good or better type of Loudon.

Second—It is yet to be proved whether the superiority of a strain obtained by the selection of strong, resistant, individual plants, is permanent, or whether there will be, in future generations, a gradual or partial reversion to the weakness of the ancestry. We should not be content to rest in the assurance that a single selection of plants, no matter how marked the improvement attained thereby may be, is sufficient for all time. Even eliminating the possibility of danger of reversion or degeneration of the improved type obtained, to the recognized weakness of the variety with which we may be dealing, it is only reasonable to assume that there may yet be further improvement of the better strains obtained by the initial selection.